FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 110
No. 2314

APRIL 13, 1961

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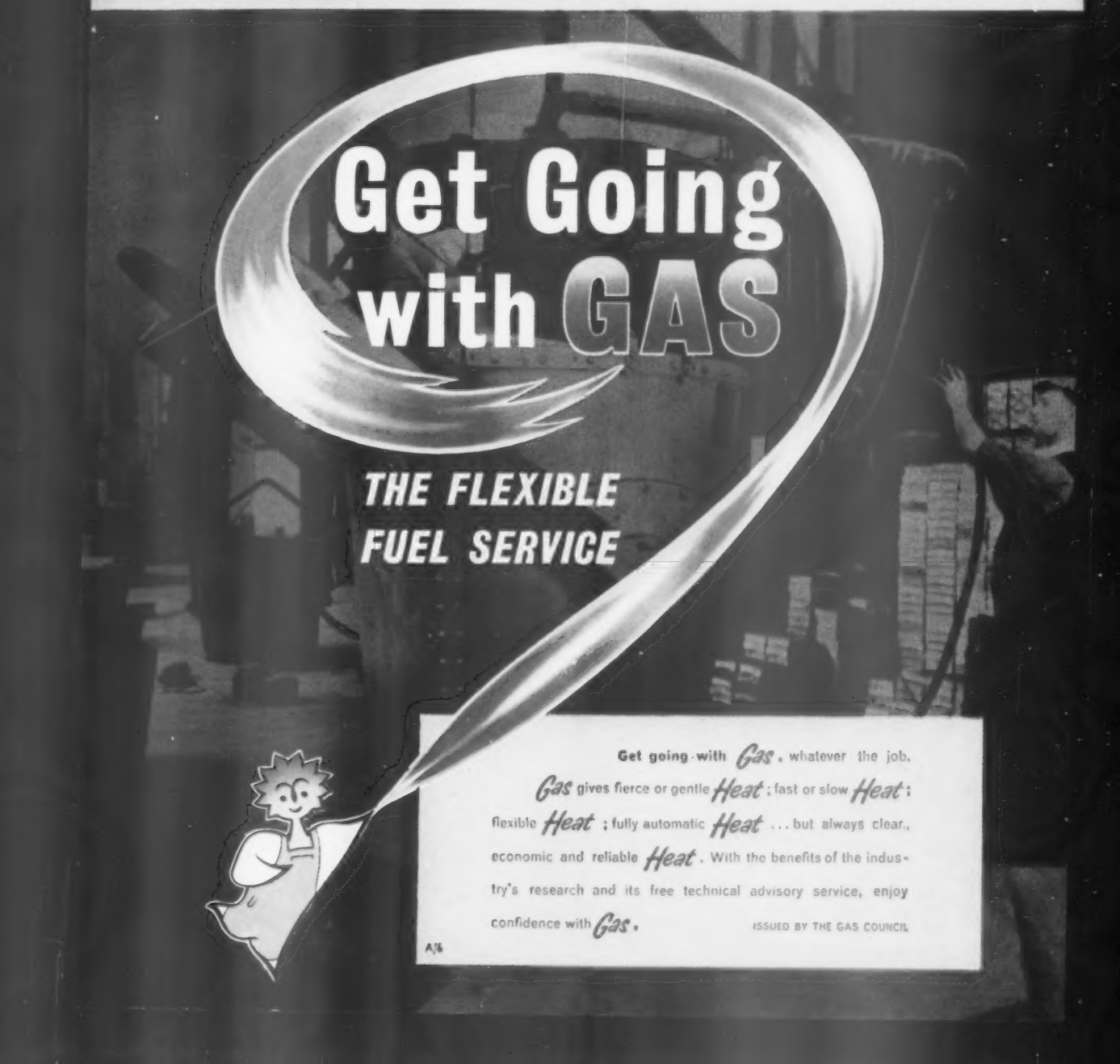
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A/6

THIS IS *the tool*
FOR INCREASED PRODUCTIVITY

Write for leaflet W.F. 101 showing full range including Floor Rammers.

The design of this Rammer is based upon the accumulative experience gained from years of practical use, and its application results in quicker and more firmer packed moulds.

R28.

CHIPPING HAMMERS • GRINDERS

FOUNDRY RAMMERS • HEAD CUTTERS

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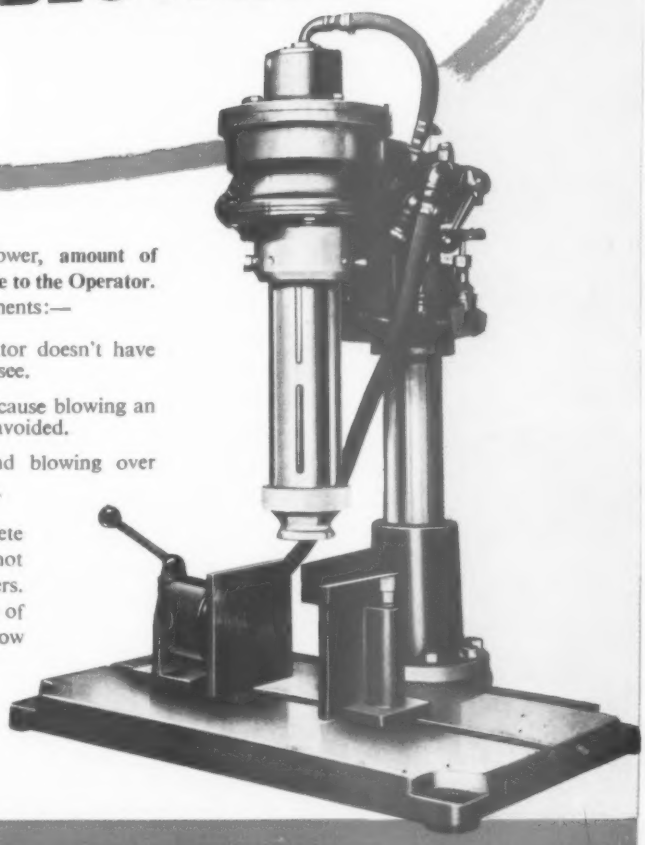
FACTORY: Tynemouth, England. Tel: North Shields 3111. Grams & Cables: Thortools, Tynemouth.

NO MORE "Blind" CORE BLOWING!



With the "Molineux" Core Blower, **amount of sand in the Cartridge is always visible to the Operator.** This effects three notable improvements:—

1—**Time saved** because the Operator doesn't have to guess when to refill—he can see.

2—**Longer Life for Core Boxes,** because blowing an insufficient quantity of sand is avoided.

3—**Operators Protected** from sand blowing over them when box is nearly empty.

In brief, the Operator has complete control of the sand, in a way not possible with most Core Blowers. There are other advantages in ease of operation, little maintenance, and low cost.

MOLINEUX

Write for full specification and, prices to:
Molineux Foundry Equipment Ltd.,
Marlborough Works,
Marlborough Rd., London, N. 19
Phone: ARChway 4127

Two famous names combine

Foseco FORDATH

. . . to serve the world's markets
with core binders

Foseco FORDATH

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Two famous names have combined to serve the world's markets with core-binders.

Foseco International Limited and Fordath Engineering Company Limited have united to form a **Foseco-Fordath Company** to licence the manufacture and sale of these renowned Fordath core-binders overseas:

GLYSO	Core Compounds
PERMOL	Core Oils
XL & EXOL	Cereal Binders
AIRBOND	Air-hardening Binders
PLASTSAND	Resin-coated Sand
FURSATIL	Furane Binder for Hot Box, Cold Setting or Baking Techniques

These established **Fordath** products will now be available anywhere in the world through the vast overseas network of the **Foseco** group, with 16 manufacturing units and 43 distributors covering 51 countries.

United Kingdom sales of core-binder products, and world sales of Fordath equipment, will continue to be carried out by Fordath.

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FOSECO INTERNATIONAL LIMITED
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THE FORDATH ENGINEERING COMPANY LTD
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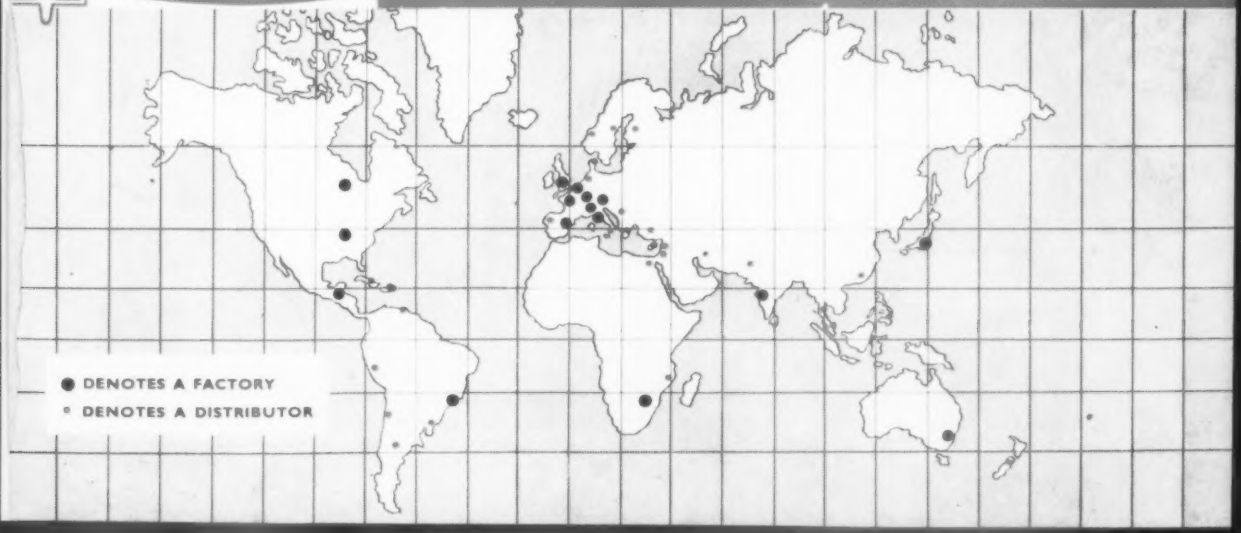

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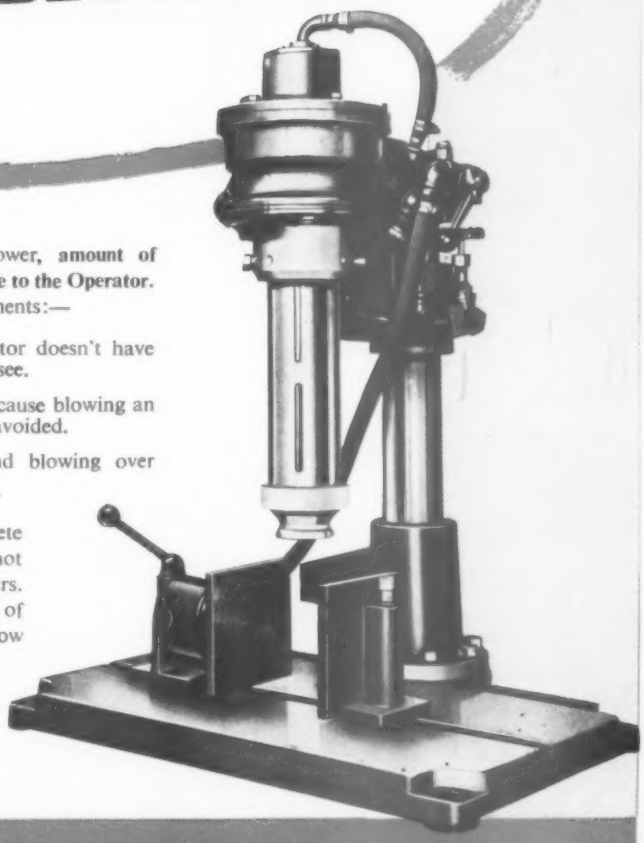

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Marlborough Rd., London, N. 19
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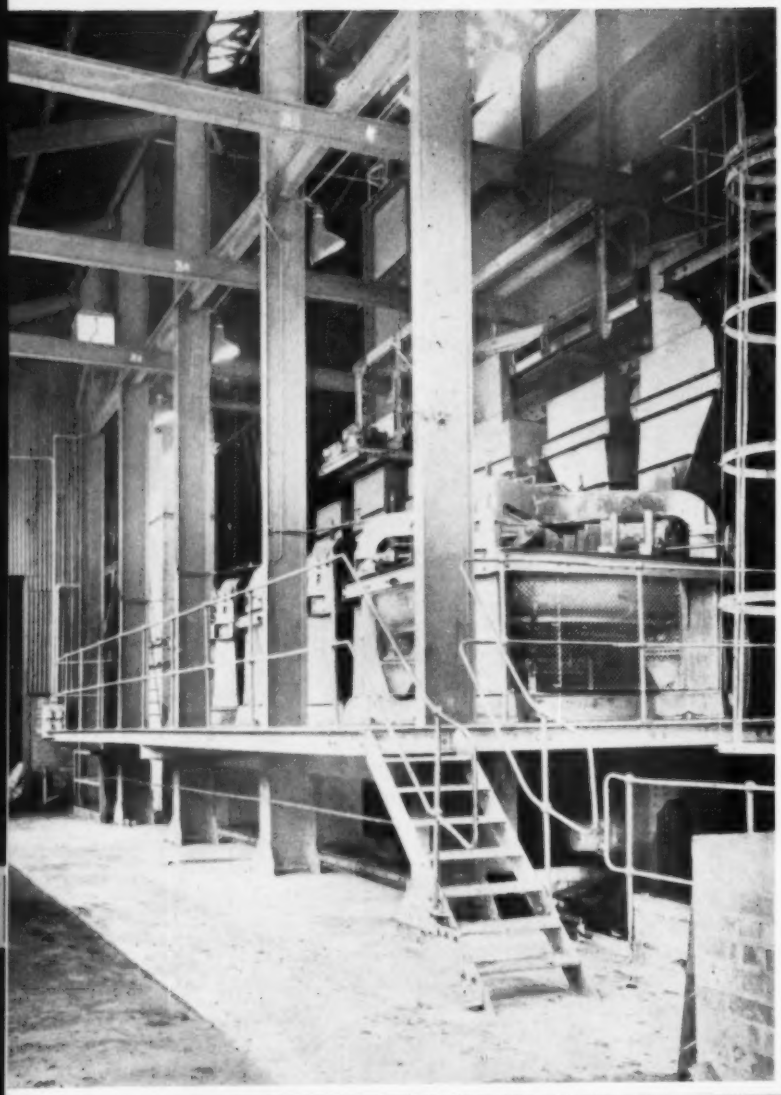

Three S.B.J Continuous Sand Mills (90 ton per hour total output) with Storage Hoppers forming part of new Sand Conditioning and Distribution System installed in new Building to step up prepared sand requirements in the large Iron Foundry of The Staveley Iron and Chemical Co. Ltd.

Some illustrations showing the two separate Foundry installations which we have been privileged to supply to our Clients, The Staveley Iron and Chemical Co. Ltd., Chesterfield.

(All photographs reproduced by courtesy of The Staveley Iron & Chemical Co. Ltd.)

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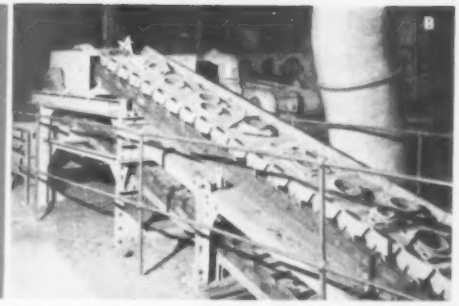
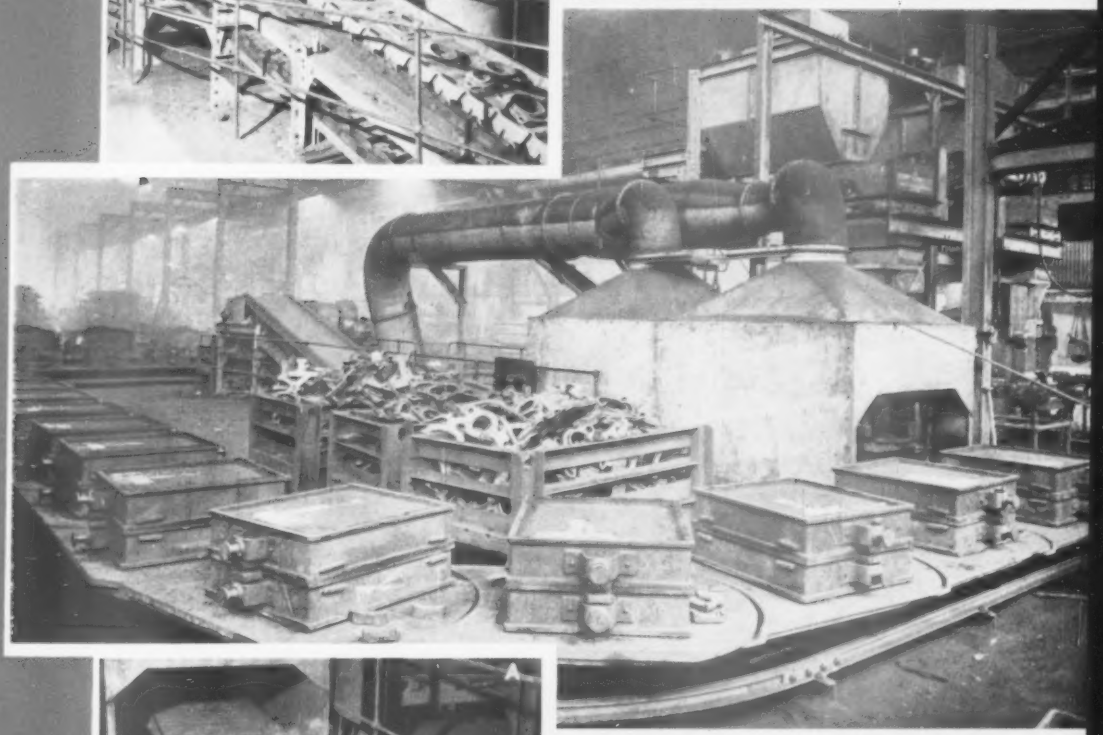
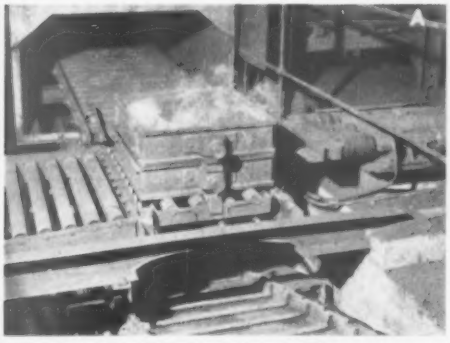
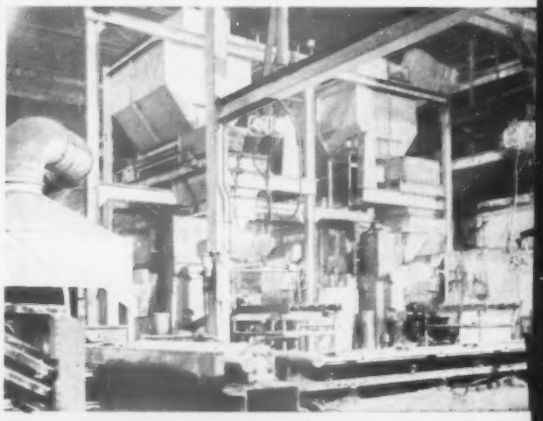


Plan of Moulds Conveyor and Enclosed Shakeout and Casting Conveyor. Inset A. shows discharge end of automatic shakeout, empty box return unit and castings dispocal. Sand falls through shakeout and returns to system. Inset B. shows heavy duty hot castings conveyor from automatic shakeout.







General View of Semi-Automatic Special Moulding Unit showing sand feed system, mould conveyor and handling plant.

OVERSEAS COMPANIES:

AUSTRALIA: Foundry Equipment (Australia) Pty. Ltd., Elizabeth, S. Australia
CANADA & U.S.A.: F. E. (North America) Ltd., Toronto
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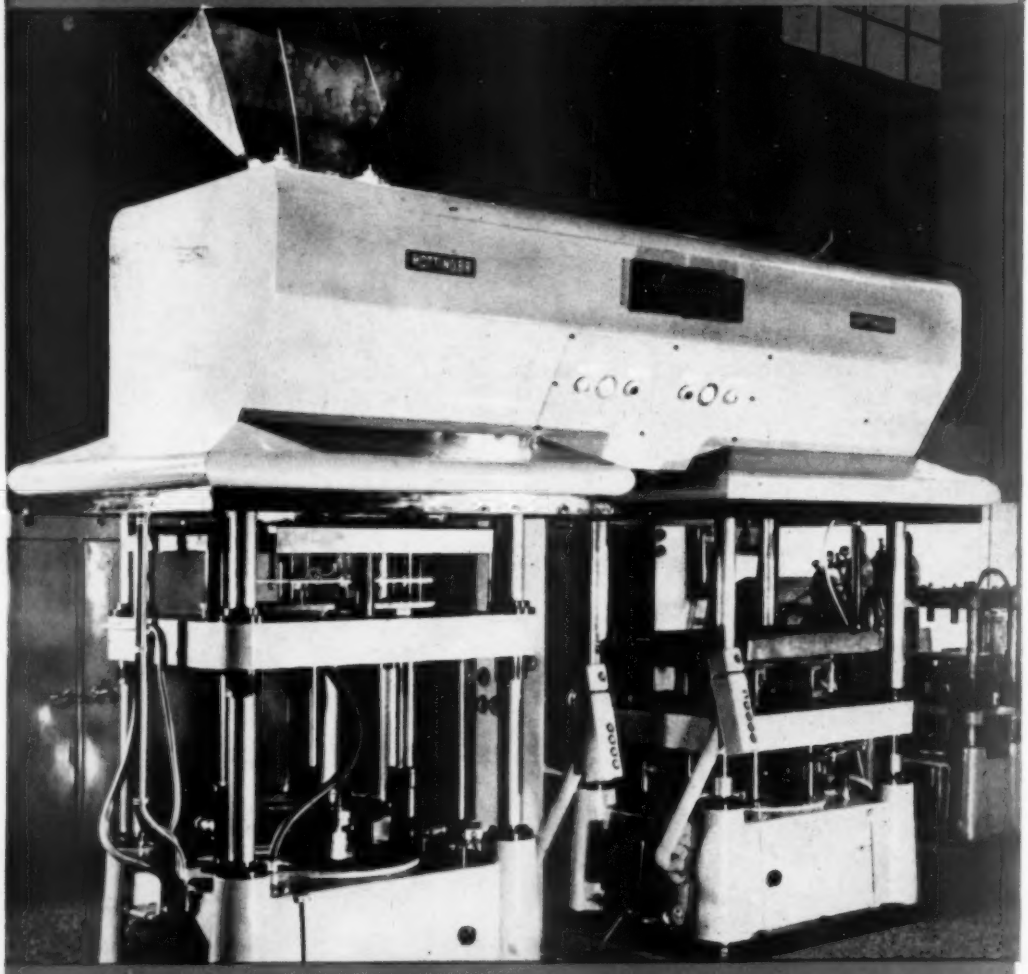
SHELL MOULDING MACHINES
FOR SHELL MOULDING AND THE "HOT BOX" PROCESS



SHELL—and CORE SHOOTING MACHINE

1 Operator 36" × 28" Fully or Semi-automatic

As installed for the manufacture of Cores for Cylinder Blocks.

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LEFT: FD4 Four wheel drive loader for adverse ground conditions.
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AND "ALUMISH" FOR ALUMINIUM
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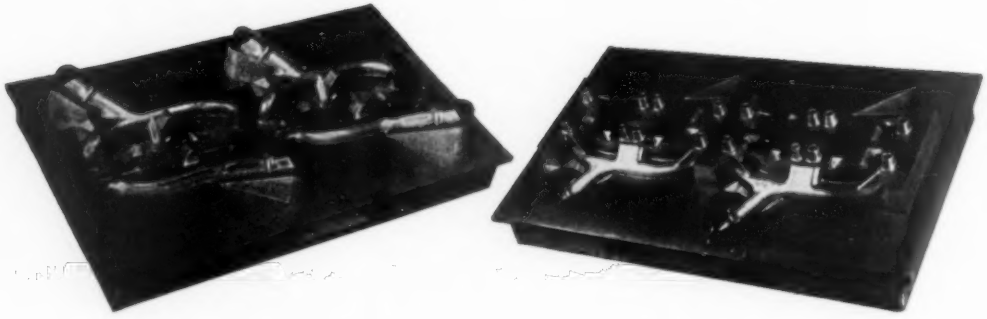

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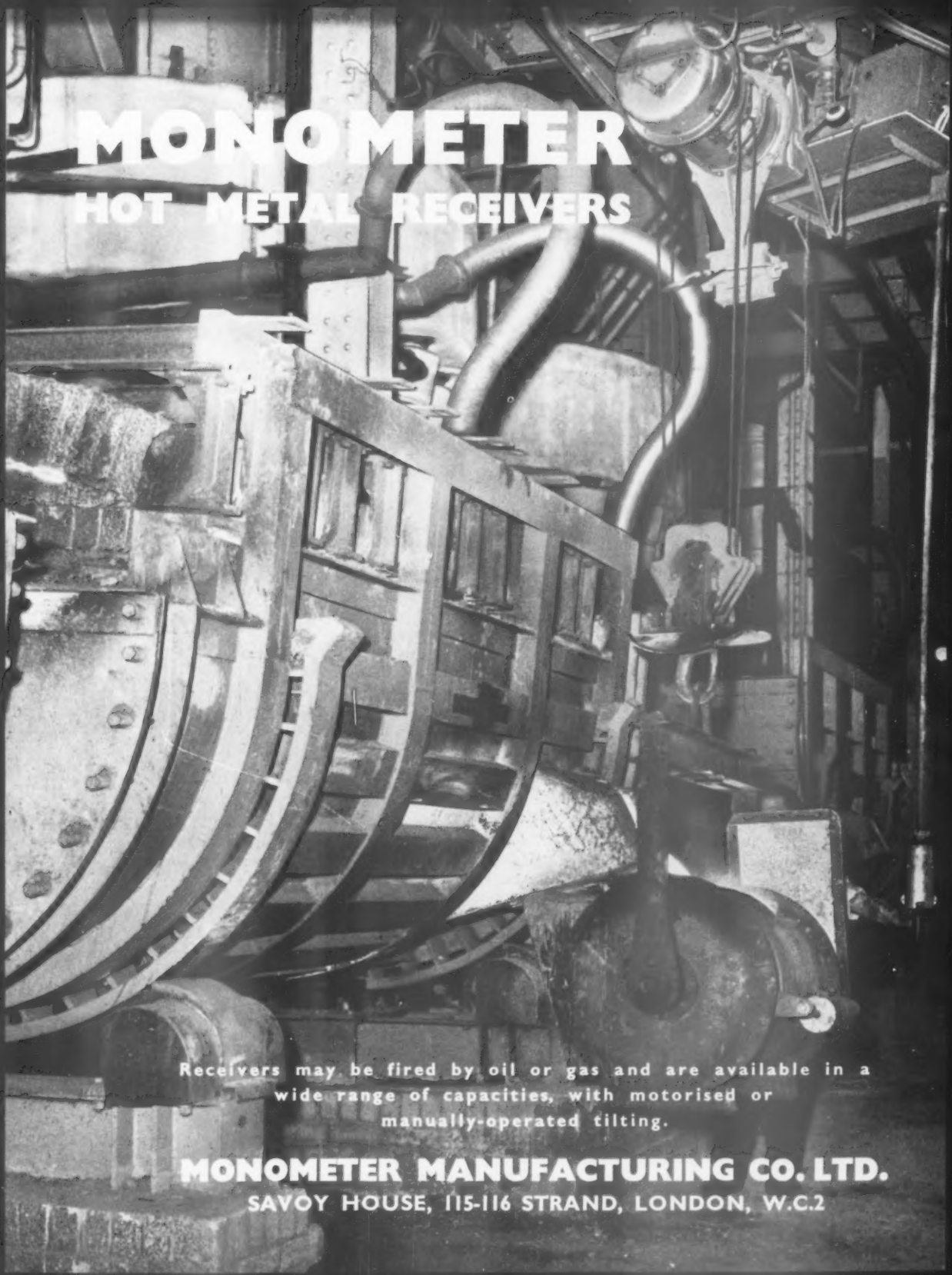
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HOT METAL RECEIVERS
Receivers may be fired by oil or gas and are available in a wide range of capacities, with motorised or manually-operated tilting.
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Illustration (reproduced by courtesy of Messrs. BILSTON FOUNDRIES Ltd.) is similar to the one described below

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One man operation—resulting in real economy of labour and real efficiency too because the human element is reduced to a single degree. With Roper Automatic Charging Cycle Installation the Crane Operator does more than operate a Crane . . . by push-button he makes up the Metallics Charge in Weigh Hopper, controls the sequence of delivering the complete charge via Drop Bottom Bucket Charger into Cupolas in a 17 ton per hour capacity furnace, and can control the Coke and Stone feed to Weigh Hopper and record Charge weights.

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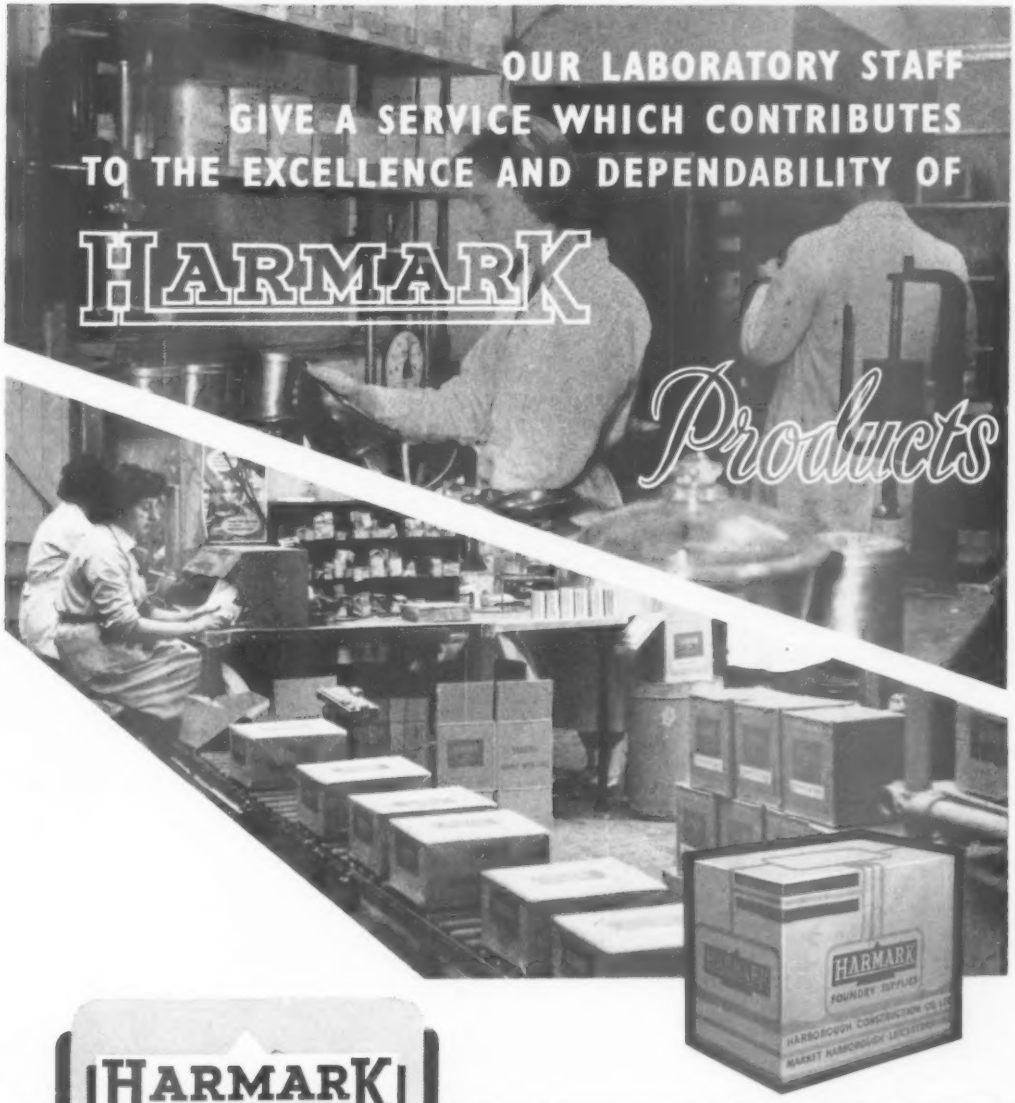

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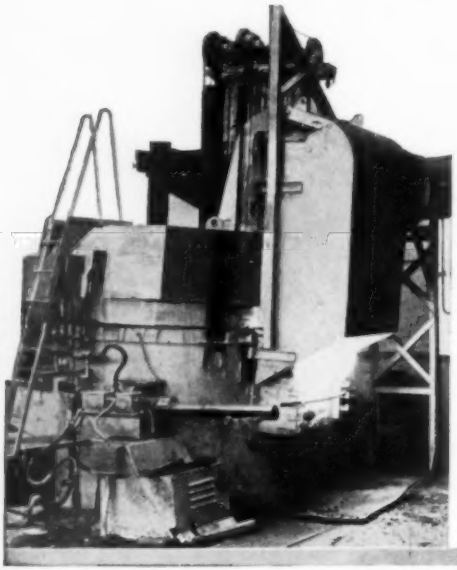
Manufactured by

HARBOROUGH CONSTRUCTION CO·LTD·MARKET HARBOROUGH

TILGHMAN'S DUST COLLECTORS



SERVING THE FOUNDRY INDUSTRY

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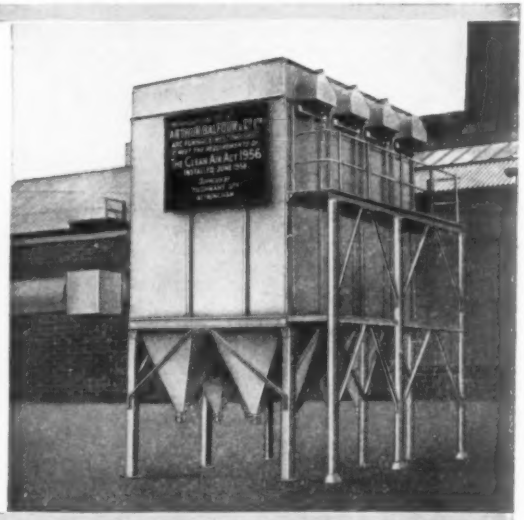
Tilghman's specialise in the design, manufacture and supply of equipment for extracting fumes emitted from electric arc furnaces, either by fitting an exhaust hood, as illustrated, or alternatively by direct extraction from the furnace body.

TUBULAR FABRIC COLLECTORS

Automatic bag filter plants with synthetic filter tubes ensure *no visible discharge to the atmosphere even during oxygen lancing.*

The plant illustrated has now been operating over eighteen months without any tube replacement.



TILGHMAN'S LIMITED

Tilghman's Limited

BROADHEATH, ALTRINCHAM, CHESHIRE

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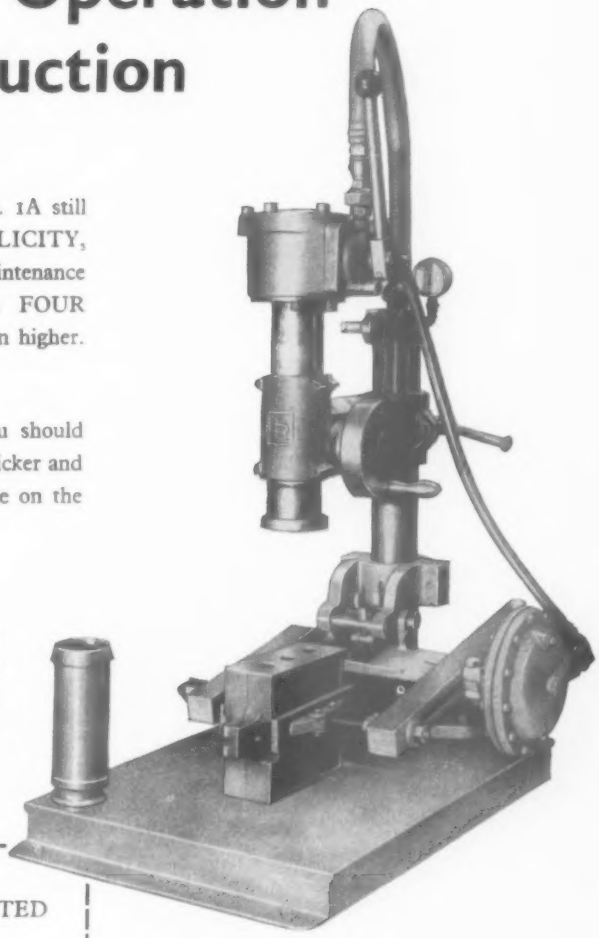
The *NEW* Redford No. 1A

Single Lever Operation Higher Production



The New Single Lever Redford No. 1A still retains its STRENGTH and SIMPLICITY, but reduces operational time, maintenance costs and labour fatigue. With FOUR operations in ONE production is even higher.

If you make cores up to 2 lbs. you should use a Redford. It will make them quicker and cheaper than any comparable machine on the world market today.

It has great adaptiveness and is used widely co-operating the CO_2 process and the design provides rapid action to all adjustable parts, including the pneumatic clamps.

To BRITISH RONCERAY LIMITED

Please send me further details of the Redford Core Blower/Redford Pneumatic Clamp without obligation.

Name .....

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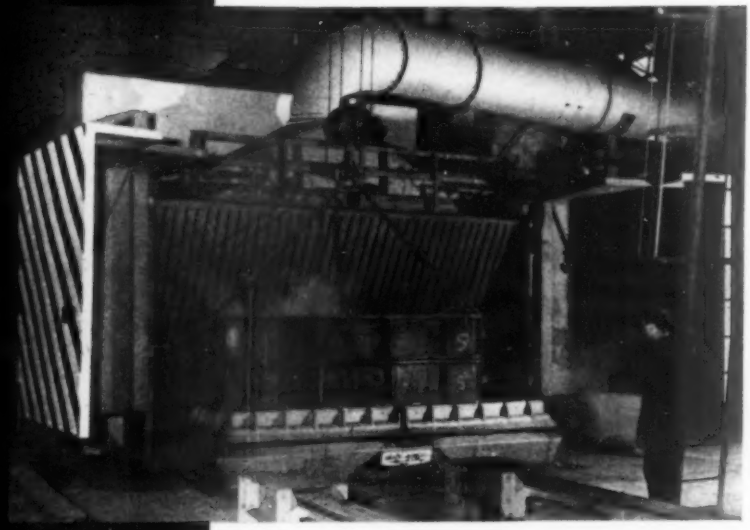
Just attach to one of your letter-headings and post to-day to:—

BRITISH RONCERAY LIMITED

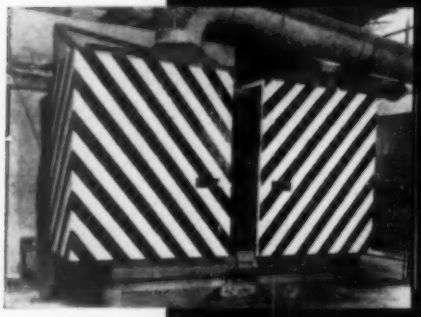
14, WOLSELEY ROAD, SHEFFIELD 8.

HOLMES-SCHNEIBLE MULTI-WASH SYSTEM

for dust collection and control



The photographs show the doors in both the open and closed positions.



An interesting feature of the Holmes-Schneible Multi-Wash installation in the steel foundry of English Steel Castings Corporation Limited are the hydro-pneumatically operated doors enclosing the shake-out hood. These doors which were designed in co-operation with English Steel Castings Corporation Limited, have been very successful in operation and have resulted in a considerable saving of exhaust volume necessary at the shake-out position. The installation is completed by two size 138 type 'JC' collectors, a dewatering tank, hoods on the sand preparation plant, fan and ducting.

For full details write for a copy of Publication No. 80/23

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N° 10

FULBOND in sodium silicate bonded sands

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2 Cores are prevented from sagging and, if necessary, can be stripped from their boxes before gassing.

3 Some of the free water in the sodium silicate is absorbed, neutralising the stickiness of the sand. Sands will, therefore, have cleaner and smoother stripping properties and patching up, if required, is made easier.

4 The break-down properties of both moulding and core sands are considerably improved.

It is appreciated that too much clay in sodium silicate sands produces friability, therefore it is essential to balance the addition of FULBOND with the type and percentage of sodium silicate used.

Either grade of FULBOND can be used in conjunction with sodium silicate.

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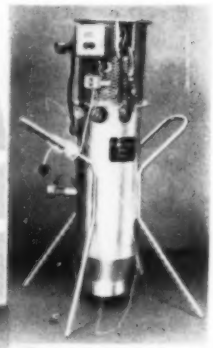
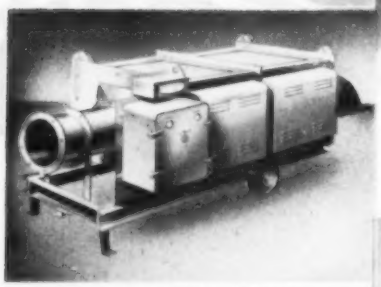


Axial Jet — M Gas Fired



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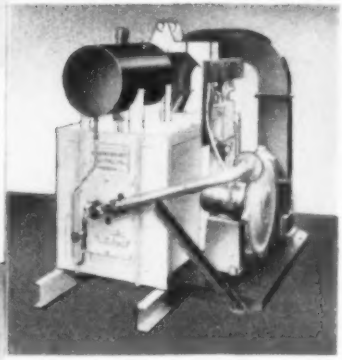
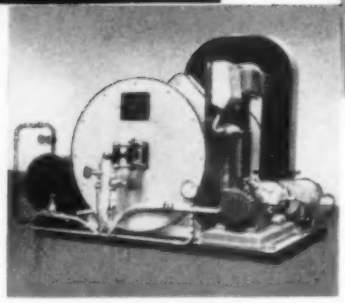


"Newstad" Oil Fired



"Junior" Oil Fired

Manufactured only by the Foundry Drying Equipment Specialists

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That's where experience scores! Use SINEX experience on your problem!

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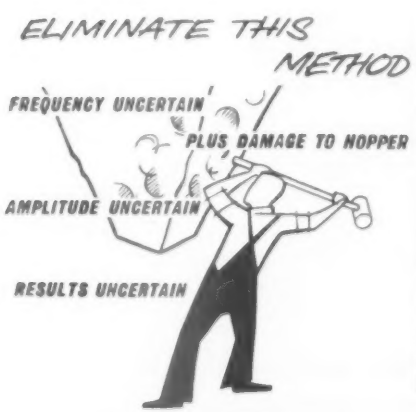

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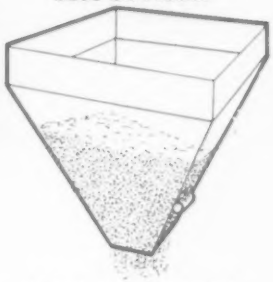
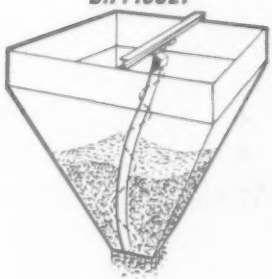


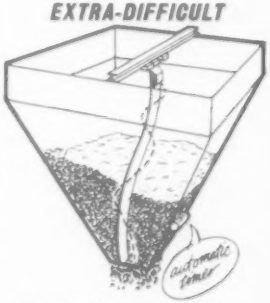
External vibrator on steel hopper.

DIFFICULT



Vibrating reed. Used where external vibration is impractical, i.e. concrete hoppers and difficult structures.

EXTRA-DIFFICULT



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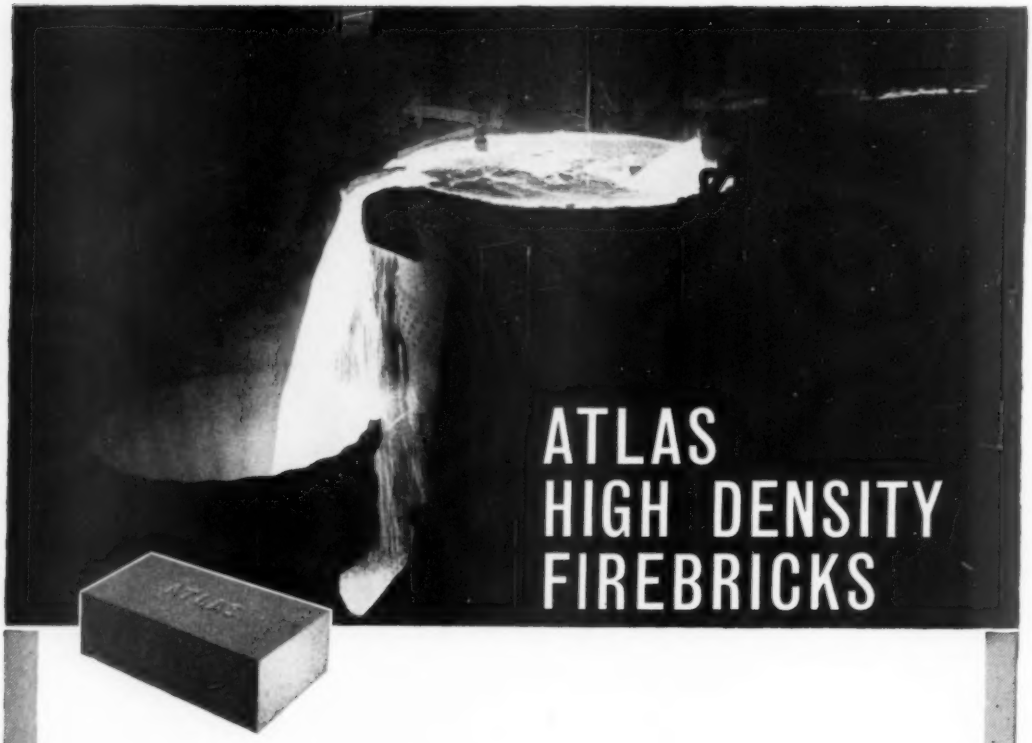

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ILLUSTRATION

Tapping a furnace at Abbey Melting Shop, Steel Company of Wales Ltd. Ladle Bottoms are ATLAS Firebricks.

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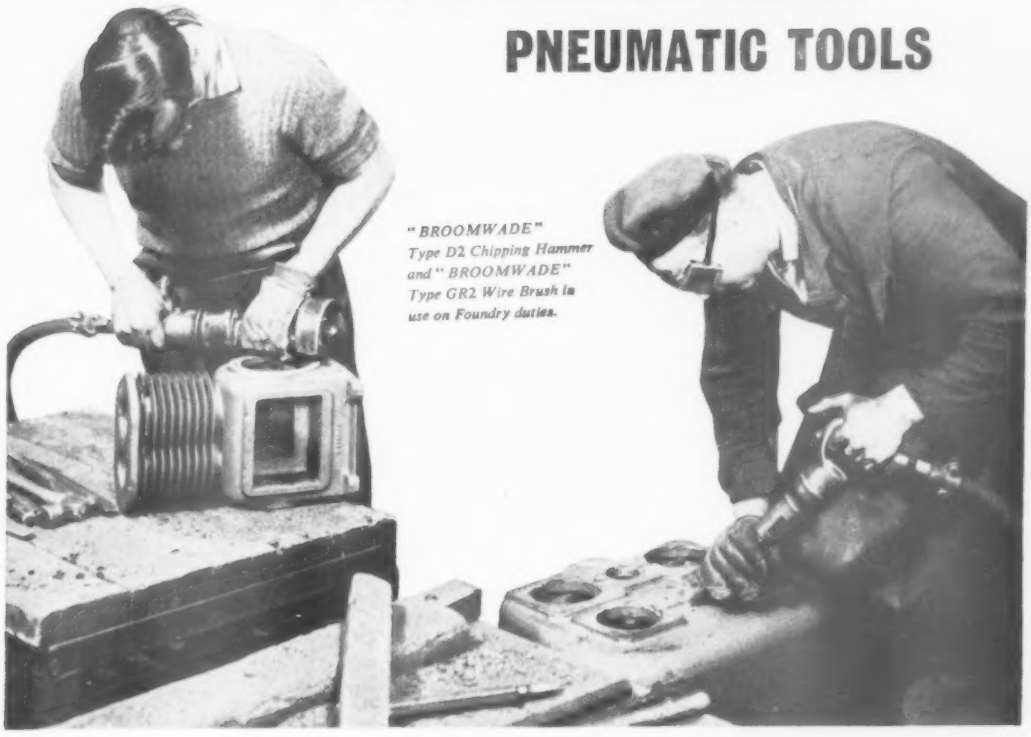

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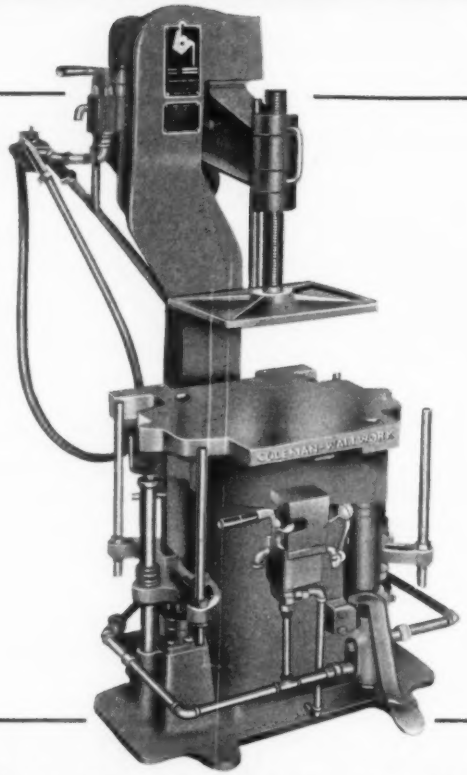

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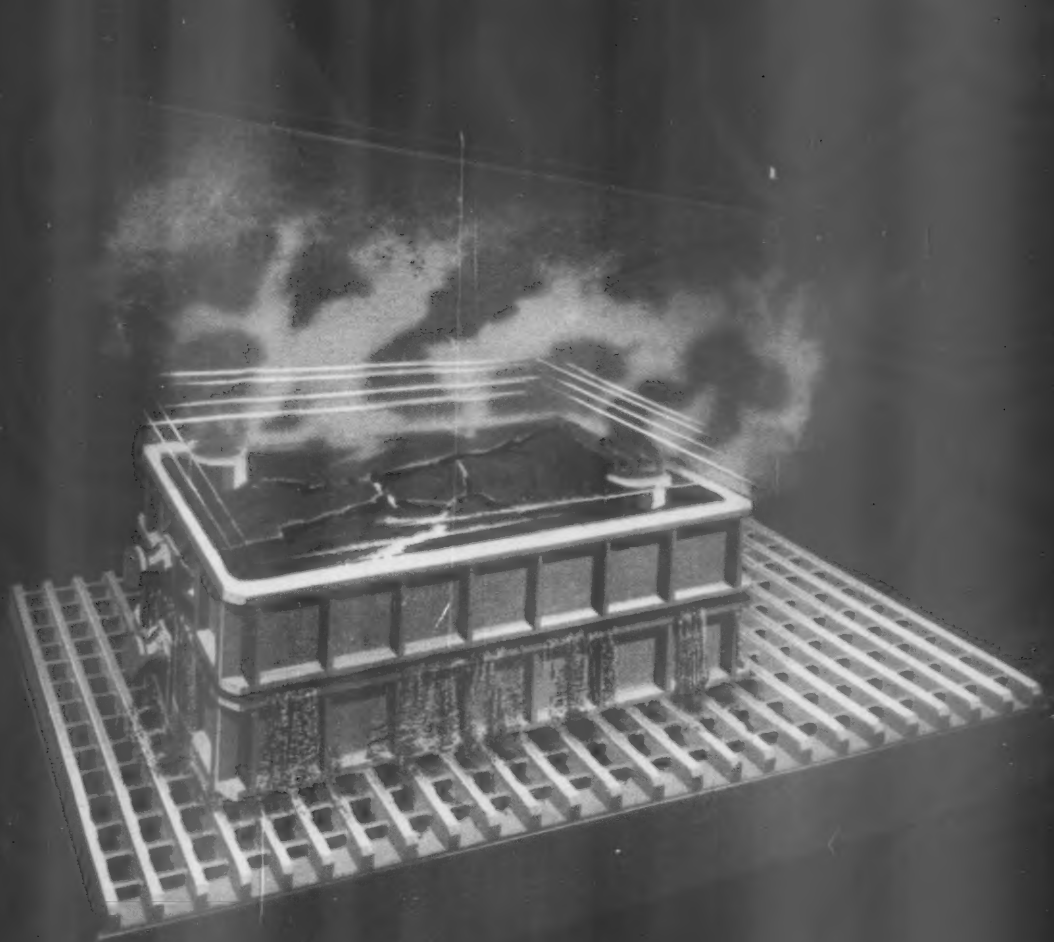

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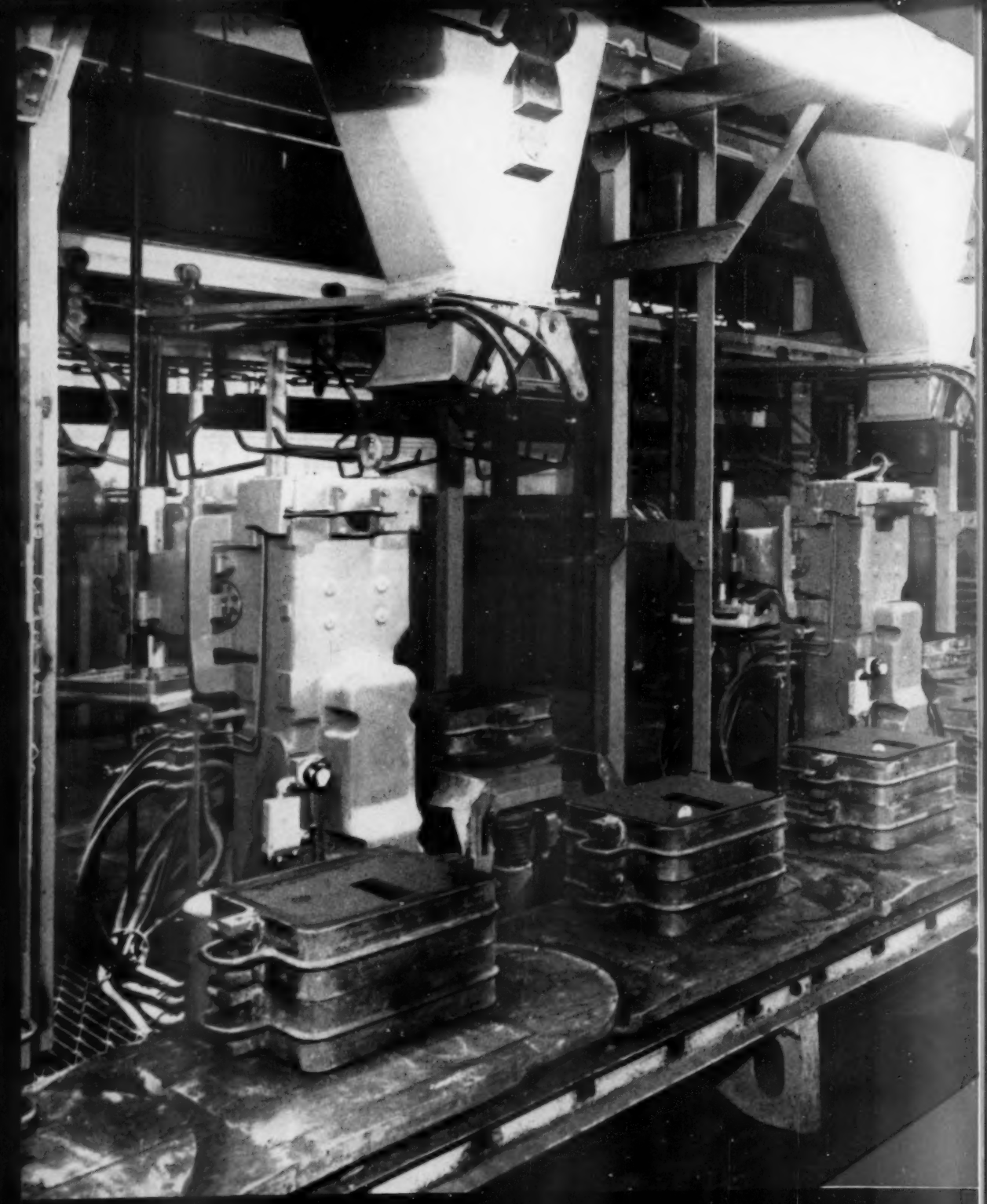

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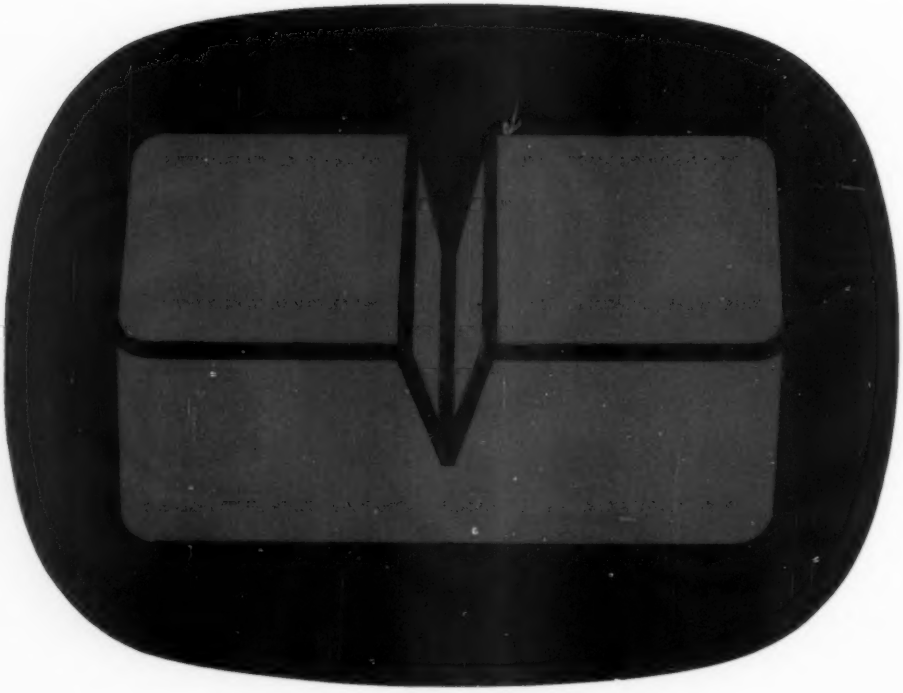
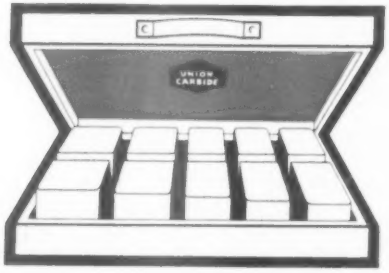


New method of Packing

The new briquettes will be packed in easily man-handled bundles of convenient weight (approximately 56 lb.) securely fastened with metal straps which can be easily released with a file tang. Quantities over 5 cwt. will be supplied on non-returnable pallets.

New Square-sided Pack easily handled and stacked

These new bundles make for easier handling and stacking—and also simplify mustering for stock-taking.

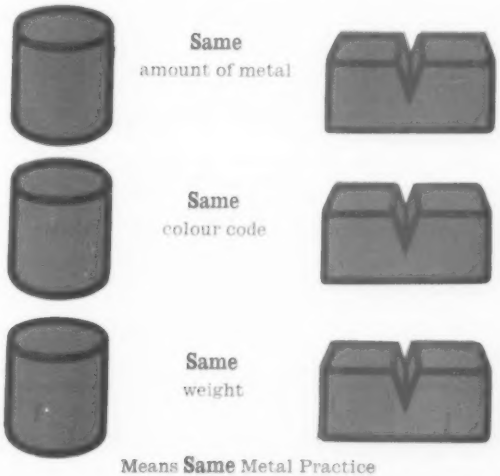


45—50% Fe Si Zr Si Si Mn Cr Mn

Reduced Prices

The new shape and method of packing means reduced production costs—*and these savings are passed on to you.* Tonnage customers do even better!

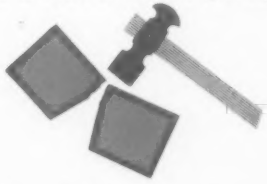
Standard Cupola Practice



Means **Same** Metal Practice

Quality Control A remarkable feature of the new briquette is its consistent quality —the result of careful quality control from the raw material stage right through the manufacturing process.

Easily and Accurately Split into 1 lb. Halves
Quality Control means that each easily separated 1 lb. half contains the same amount of additive.



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Let us know if you want trial lots of any or all of them.

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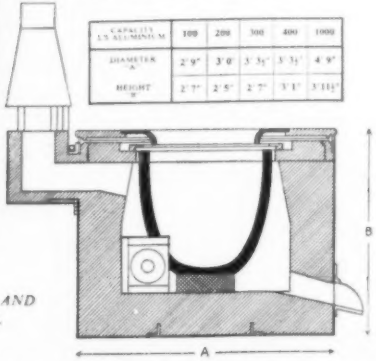
HEIGHT B	2'7"	2'5"	2'7"	3'1"	3'11½"



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The foundry industry of the United Kingdom is represented by the following organisations, many of whose proceedings are regularly reported in this JOURNAL:—

Ironfounding Employers' Associations

COUNCIL OF IRONFOUNDRY ASSOCIATIONS

Chairman: **M. J. Glenny**, Dover Engineering Works, Limited, Arundel St., London, W.C.2. *Director:* **Kenneth Marshall.** *Ass. Director:* **J. W. Butler.** *Secretary:* **D. L. Farrant,** 14, Pall Mall, London, S.W.1. 'Phone: WHitehall 7171. *Participating Associations:* British Cast Iron Research Association (affiliated); Institute of British Foundrymen (affiliated), and the following: **Association of Automobile and Allied High-duty Ironfounders.** Secretaries, Heathcote and Coleman, 69, Harborne Road, Edgbaston, Birmingham, 15. 'Phone: Edgbaston 4141. 'Grams: "Clarify," Birmingham, 15. **British Ironfounders' Association and British Bath Manufacturers' Association.** Director and Secretary: J. Galbraith Sneddon, C.A., 145, St. Vincent Street, Glasgow, C.2. 'Phone: Central 2891. 'Grams: "Groundwork," Glasgow. **British Grit Association** (affiliated). Secretary: J. Campbell MacGregor, 10, Bank Street, Airdrie, Lanarkshire. **British Malleable Tube Fittings Association.** Secretary: F. B. Ridgwell, 196, Shaftesbury Avenue, London, W.C.2. 'Phone: TEMple Bar 6052-3. 'Grams: "Brimatufia," London. **Cast-Iron Chair Association.** Secretaries: Peat, Marwick, Mitchell & Co., The Cast Iron Chair Association, Queen's Square, Middlesbrough, Yorkshire. **Cast Iron Heating Boiler and Radiator Manufacturers' Association.** Secretary: J. R. Aldam, 69, Cannon Street, London, E.C.4. 'Phone: CITy 4444. **British Cast Iron Pressure Pipe Association.** Secretary: W. I. Campbell, 14, Pall Mall, London, S.W.1. 'Phone: WHitehall 7941. **Cast Iron Segment Association.** Secretary: W. Rose, Stanton Ironworks Company, Limited, P.O. Box 3, near Nottingham. **National Association of Malleable Ironfounders.** Secretary: E. N. Turner, Chamber of Commerce Offices, Tudor House, Bridge Street, Walsall. 'Phone: Walsall 5671. **National and Midland Ironfounders' Association.** Secretary: F. W. Sims, 69, Harborne Road, Edgbaston, Birmingham, 15. **National Ingot Mould Association.** Secretaries: Peat, Marwick, Mitchell & Company, 301, Glossop Road, Sheffield. 'Phone and 'Grams: Broomhill 63031. **Roll Makers Association of Great Britain.** Secretaries: Peat, Marwick, Mitchell & Company, Beaufort House, Newhall Street, Birmingham, 3. 'Phone: Central 6661-3.

NATIONAL FEDERATION OF ENGINEERING & GENERAL IRONFOUNDERS

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Other Employers' Associations:

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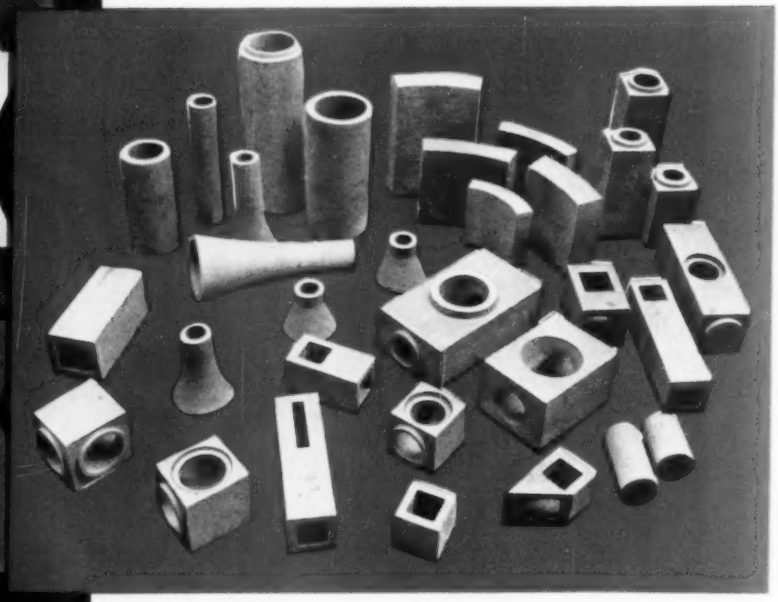

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Telephone: Trafalgar 6171 (Private Branch Exchange)

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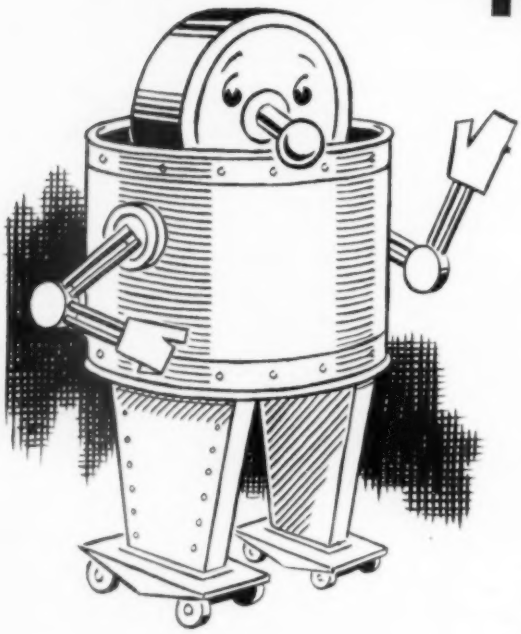

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Austrian Foundry Industry

Austria can be regarded as the cradle of the metallurgical industry of Europe. To-day, even if it has not a very large output of metal products, at least during the last decade it has shown remarkable progress. For instance, the output of steel went up from 650,000 *tonnes* in 1937 to 2¼ million *tonnes* in 1960. Similar growth has been shown in the output of castings. The production of grey-iron castings is now running about 197,000 *tonnes* per annum as against 44,400 in 1947. The corresponding figures for steel castings, malleable, copper-base alloys and aluminium were (with the 1947 outputs in brackets):—steel 21,492 (3,672); malleable 9,674 (780); copper-base alloys 3,816 (552), and aluminium 4,704 (1,516) *tonnes*. There are 134 foundries in the republic of which 68 are purely iron foundries, 47 purely non-ferrous and 19 are mixed. In the ironfoundry figures, there are included five malleable and steel foundries. Nineteen foundries have been mechanized in the industry which employs 13,526 people, of whom 355 are apprentices. The breakdown of the personnel of the industry is interesting. There is one foundry employing over 1,000 workpeople, six having between 500 and 1,000, eight having between 200 and 500, 14 employing between 100 and 200, 28 between 50 and 100, 35 between 20 and 50, and 41 having fewer than 20 men.

The castings made by these firms include railway castings, textile-engineering castings, ingot moulds, machine-tools, automobile, bell and art castings, pianoforte frames and stove grates, but cast bath-tubs have to be imported, coming mainly from Germany; there is, however, some indigenous production of pressed-steel baths. It would appear that Germany is also the main source of foundry plant—though this needs confirmation—but British manufacturers enjoy a steady market in Austria for crucibles and foundry fluxes, etc. The country has good native resources of pig-iron and moulding sand, but has to rely on imports of coal for foundry coke which is made at Linz, as Austrian coal is of the non-coking variety. The output of indigenous oil is rapidly expanding, as is also electricity production.

Austria, need one be reminded, is a signatory to the " Outer Seven " trade organization and is anxious to increase its business with Great Britain. Traditionally, it is a German market, but this is vulnerable to British foundry plant and general-engineering competition. This is just one of the many reasons why the British should support the forthcoming 28th International Foundry Congress which is to be held in Vienna from June 19 to 24. Other reasons are that they are assured of a warm welcome from their hosts and participation in a programme of outstanding social events. Finally, the city of Vienna and its countryside alike are very beautiful.

Institute of Vitreous Enamellers

Twenty-seventh Annual Conference

The 27th annual conference of the Institute of Vitreous Enamellers is to be held at Hotel Majestic, Harrogate, from May 24 to 27, 1961. Particulars of the programme are as follow:—

Wednesday, May 24. 4.0 p.m. Conference office opens. 7.0 p.m. Official opening of the conference and Confair 1961, by His Worship, The Mayor of Harrogate, followed by a reception for all delegates and ladies.

Thursday, May 25. 9.0 a.m. Coaches leave for visit to either British Titan Products Company, Limited, Billingham, Co. Durham, or the General Electric Company, Limited, Mexborough, Yorkshire. 5.30 p.m. Coaches return to hotel. 7.30 p.m. "Edwardian Night," comprising a dinner and entertainment.

Friday, May 26. 9.30 a.m. Technical Session "A"—"Interfacial Reactions"—a sub-committee report. 10.30 a.m. Coffee break. 10.45 a.m. "Electroluminescent Enamels"—P. W. Ranby. (Thorn Electrical Industries, Limited). 11.45 a.m. "Enamelling for Architectural Purposes"—D. Mill (Escol Products, Limited). 1.0 p.m. Luncheon. 2.15 p.m. Technical-session "B"—"Conditions and Considerations of the Modern Weekly Wash"—F. Pennock. (Thomas Hedley & Company, Limited). 3.15 p.m. Tea break. 3.30 p.m. "Economics of Low-pressure spraying"—J. Muirhead, (Aerograph-DeVillbiss Company, Limited). 4.30 p.m. "Testing Methods." 7.30 p.m. Gala dinner/dance.

Saturday, May 27. Conference disperses.

Ladies' Programme

Wednesday, May 24. 7.0 p.m. As for delegates.

Thursday, May 25. 10.0 a.m. Coaches leave for tour of Yorkshire Moors and Dales. 5.0 p.m. Coaches return to hotel. 7.0 p.m. As for delegates.

Friday, May 26. 10.30 a.m. "Choosing Antiques for the Modern Home." An illustrated talk by Robert Aagaard. 1.0 p.m. Join delegates for luncheon. 2.15 p.m. Ladies are invited to joint delegates for a paper on "Conditions and Considerations of the Modern Weekly Wash," by F. Pennock, of Thomas Hedley & Company, Limited, which may be of particular interest to them. Evening programme as for delegates.

Tickets for the various events will be forwarded to delegates before the Conference opens and it is hoped to circulate advance copies of papers to be presented during the various technical sessions. These will be included in the Conference handbook which will be distributed free to all delegates. The handbook will also contain a catalogue giving details of the exhibits appearing in Confair, 1961, a special Conference Trade Fair which is being held in conjunction with the Conference.

All application forms must be returned by May 8, 1961. Further details and application forms can be obtained from the secretary, Mr. J. D. Gardom, John Gardom & Company, Ripley, near Derby.

Southern Section Social Evening

The annual social evening of the southern section of the Institute, to be held on Friday, April 28, will include a visit to the theatre, preceded by dinner, to which members, ladies and guests are invited. The dinner will be held in the Gallery Lounge of the Grosvenor Hotel, Victoria, London, S.W.1, and the party will then go to the Victoria Palace where the Crazy Gang are presenting their final revue, the

(Continued at foot of Col. 2)

"Young in Heart." Members wishing to participate are asked to complete and return reply forms to the hon. secretary of the section, Mr. L. E. Turner, Balbardie, Limited, 46, Kingsway, London, W.C.2, not later than April 24. (Cost of tickets for dinner and theatre is £2 2s. each.)

Foundry Art and Craft Exhibition

The Association of Bronze & Brass Founders have recently circularized members regarding the Foundry Art and Craft Exhibition which is to be held in Birmingham University from June 20 to 22. The Exhibition is designed to interest undergraduates including those who have taken their examinations and are waiting for "degree day," (of whom there are some 4,000, including many students of engineering and allied subjects), and presents an opportunity to bring to their notice the many uses of castings and their importance to industry; it is also hoped that the Exhibition will be visited by young people of school-leaving age. Various sections of the foundry industry in addition to the foundry equipment side, and other services are staging good displays, and the ABBF make the plea that it is desirable that bronze and brass founders should take this chance of sales promotion among those who will undoubtedly form future executives of the engineering industry.

Co-operation is requested by the loan of exhibits, the ideal being to show a drawing of a casting, the pattern, two half-moulds and a finished casting, together with an illustration of the casting in service, if possible. The secretaries of the Association, Heathcote and Colemen, 69, Harborne Road, Edgbaston, Birmingham, 15, would like to have from members offers of the loan of such exhibits or of photographs or of other material of interest, and undertake to pass on material to the University in order that the organizers may make their selection.

Forthcoming Events

APRIL 17

Institute of British Foundrymen

East Anglian section:—Annual general meeting and presentation of the L. J. Tibbenham short-paper competition award, 7.30 p.m., at the Civic College, Grimwade Street, Ipswich.

APRIL 18

National Society of Master Patternmakers

Works visit to Cook, Welton & Gemmel, Limited, Beverley, 10.30 a.m., followed by afternoon visit to Priestman Bros., Limited, Hull.

APRIL 19

Institute of British Foundrymen

London branch:—Annual general meeting at 7 p.m., followed by apprentices' evening, at the Constitutional Club, Northumberland Avenue, W.C.2.

APRIL 20

Liverpool Metallurgical Society

"Continuous Casting of Aluminium Alloys," by W. M. Doyle, followed by annual general meeting, 7 p.m., in the Department of Metallurgy of the University of Liverpool.

APRIL 21

West of England Metallurgical Society

"Temperature Measurement," by J. A. Hall, 7.30 p.m., at the College of Technology, Ashley Down, Bristol, 7.

Institute of British Foundrymen

Bristol & West of England branch:—Annual general meeting, 7.30 p.m., at the Royal Hotel, Bristol.

East Midlands branch:—Annual dinner/dance, at the University, University Park, Nottingham.

London branch:—"Men Only" dinner, 7 for 7.30 p.m., at Lyons' Corner House, Tottenham Court Road, W.1. Informal dress. Tickets (25s.) from W. R. Buxton, Eyre Smelting Company, Limited, Merton Abbey, London, S.W.19.

Centrifugal Casting

*By J. B. McIntyre, M.Sc., F.I.M.**

Over a century of patent literature testifies to the stimulus that the idea of producing castings with the aid of centrifugal force has been to the inventiveness of generations of foundrymen. Today centrifugal casting has a firmly established application to the production of tubular shapes and is a practicable consideration for many other more-complex cast forms. The following comprehensive and readable survey of current centrifugal-casting methods is presented in order to cover modern developments and to assist new entrants in the industry to appreciate the principles on which now well-established techniques are based. The illustrations depicting the various types of centrifugal-casting operations will greatly assist foundrymen familiar with the orthodox methods of production to get the "feel" of this specialized field.

The two processes that approach the ideal in castings production, are the centrifugal- and the continuous-casting methods. Centrifugal-casting techniques may be used in the production of simple shapes such as discs and tubes, or for the production of sand castings of more-intricate shape, whilst continuous casting is normally restricted to ingot and billet production, and is widely used for that purpose in the non-ferrous field—and also, although to a lesser extent, for grey cast iron and steel. Both methods are of considerable value, for they enable a greater tonnage of sound castings to be obtained from a given weight of molten metal than would be the case if other casting methods were used. Additional and probably more-important features of these techniques are the uniform quality, improved soundness, and comparative freedom from segregation which can result from their use.

Principles

Centrifugal casting processes are based upon the application of centrifugal force to assist feeding during solidification, and in certain cases to promote the separation of dissolved gases and other undesirable impurities, such as slag. The application of this principle is quite old, and many patents have been granted in this country and abroad. In 1849 Shanks was granted a British patent to cover the production of hollow cylindrical vessels without the use of cores. Eckhardt claimed in 1809 "the use of moulds revolvable with their axes either horizontal, inclined or vertical, in order that centrifugal force due to the revolution may press the fluid metal against the interior surfaces of the mould, and more perfect castings thereby be produced." Bessemer is reported as having used a rotating mould in the course of his early experiments to produce sound steel from blown converter charges. The introduction of ferro-manganese as a deoxidising agent by Mushet solved the problem before centrifugal methods became established. A large patent literature has accumulated during the past 100 years, though workers have, in the main, restricted their claims to new types of centrifugal machines, or methods of handling the liquid metal, or the castings produced by the process.

Advantages

The essence of centrifugal casting was admirably stated by Eckhardt in his patent claim, and the virtues of the process may best be considered in relation to the static casting methods in more general use. When a simple hollow cylinder is cast in a static sand-mould, the molten metal or alloy is comparatively-slowly cooled; dissolved gases and impurities tend to be rejected inward from the mould faces and to collect in the centre of the casting wall. This may also occur in the feeder head which is generally provided to combat the volume-change taking place, when the metal or alloy passes from the liquid to solid state. The piped area in steel ingots is known to be generally richer in impurities than the surrounding material, and a similar feature can be expected in large steel castings produced in sand moulds when examined in the as-cast condition. In contrast, a similar tubular casting produced by centrifugal methods freezes in a somewhat-different manner. Each successive layer of metal applied to the mould sustains a pressure gradient across its radial thickness, the pressure being at its maximum in the outside layers and tending to decrease toward the inside. This gradient assists in the removal of gases and restricts the effect of liquid shrinkage to the inner surface of the cylinder.

Yield

It will be appreciated from the foregoing remarks that sound gas-free castings, which show a high-ratio of useful-casting to liquid-metal used, may readily be obtained when centrifugal methods are practised. The process is applied to both ferrous- and non-ferrous-alloys and more rarely, to pure metals such as copper— in the production of calico-printing rollers. Centrifugal casting is usually regarded as an improved technique which can be applied to most castings in order to obtain the advantages already outlined.

* The Author is senior lecturer, National Foundry College, Wolverhampton.

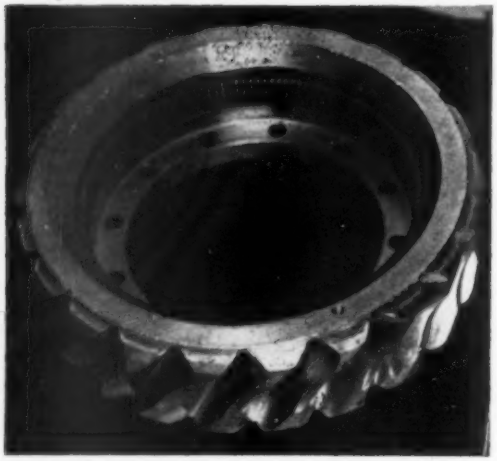


FIG. 1.—*Tin/bronze gear produced from a vertically-spun casting. The removal of surface metal by heavy machining renders the method of moulding—with its marked influence on metal segregation—of critical importance.**

Sole Application

In addition to improved quality there are instances, however, in which centrifugal casting is the only possible production method. For example, when a limited number of highly-alloyed-steel tubes are required for chemical plant operating at elevated temperature and high pressure, such material frequently cannot be handled in the standard tube-making equipment. Moreover, few mills can handle economically the limited quantity of such tubes which are usually needed. A Swiss company has proposed the use of horizontal-axis equipment to produce cast non-ferrous rings which can be split, straightened, and used as high-quality material equivalent to wrought bar.

Cooling Rate

The effect of cooling rate on soundness and grain size are well known, and it should be noted that these effects are even more pronounced in centrifugally-cast material. Tin-bronzes, for example, exhibit considerable changes in microstructure when cast by various methods. The $\alpha+\delta$ eutectoid which is a normal constituent of most industrially-important tin-bronzes may occur in several forms, depending upon the casting-method used, and the physical properties are markedly affected by the size and distribution of the eutectoid. In the same way the dispersion of insoluble elements, such as lead, is similarly influenced by cooling rate and casting method. Tin-bronzes find wide application where their resistance to abrasion and heavy loading is of value for bearings, worm wheels and so on. Sand-cast material is not so efficient for such purposes as is the chill-cast material and the latter is, in turn, less efficient than that cast in a rotating chill-mould. Gear-wheel blanks are subjected to extensive machining operations (Figs. 1, 11, 12) before use and in the case of sand-cast material, the sounder and harder metal situated on the outer rim of each casting may be removed leaving somewhat inferior metal to form the gear teeth—a condition which does not arise with centrifugally-chill-cast components.

HORIZONTAL-AXIS CASTING

Centrifugal casting may be considered in two main sections— horizontal- and vertical-axis casting respectively. Some inclined-axis casting is also carried out, but this technique is not so widely used. Horizontal-axis machines are widely used in the production of castings having a tubular shape—water pipes, cylinder liners, piston-ring pots, gun barrels and tubes for chemical plant—and the greatest tonnage of centrifugal castings is produced by this method. When a quantity of liquid metal or alloy is introduced into a rotating horizontal mould, the metallic material is distributed over the inner surface of the cylinder due to the velocity of rotation, the friction that is set up between the liquid metal and the mould material allowing the former to be distributed evenly. The inner surface of the casting assumes a cylindrical shape, and if the mould is rotated for a long-enough period a tube is obtained. The wall thickness is controlled by the quantity of metal introduced and the size of the mould used.

Straight socket-pipes for pressurized water supply, drainage, etc., are produced in large numbers by the horizontal-axis centrifugal-casting process. Cast iron is the usual material, and two principal methods find application in this field. They are the Stanton-De Lavaud-Mairy, and the Moore Sand-spun processes. The former method accounts for the bulk of pipe production, although large quantities of sand-spun pipes are also made. It is probable that centrifugally-cast pipe occupies first place in the cast-iron field, as far as tonnage production is concerned. The two processes are essentially similar, differing only in details of mould construction and the method used to introduce the metal supply. The sand-spun method tends to be more flexible than the metal-mould technique as heat-treatment in this case is not essential, and flanges and so on may be incorporated in the pipe casting. This is not so rapidly done with the latter method, although pipes can be produced more rapidly in this metal-mould process than in the sand-lined.

Metal-spun Pipes

The Stanton-De Lavaud-Mairy process utilizes a water-cooled chromium/molybdenum-steel mould (Fig. 2) which is accurately machined from a forging to provide the outer profile of the pipe casting. The steel-mould rotates on rollers within a water-cooled container which is mounted on wheels, and is designed to traverse a steel track

* Grateful acknowledgment is made to a number of firms for the illustrations used in this article, amongst them, Leyland Motors, Limited, Staveley Iron and Chemical Company, Limited, Constructional Engineering Company, Limited, Sheepbridge Engineering, Limited, Foundry Equipment, Limited, and P.I. Castings (Altrincham), Limited.

placed on a slightly-inclined machine-bed. Movement is controlled by a hydraulic-cylinder mechanism. Metal at a temperature not greater than 1,400 deg. C. is supplied to the mould by means of a tilting hopper containing sufficient iron to produce one pipe. The hopper is supported on a frame, which carries a short launder or spout, enabling liquid metal to be transferred to a long cantilever pouring trough, and hence to the pipe mould. In the original De Lavaud system the pipes tended to be chilled to some extent, but the application of a thin layer of mixed ferro-silicon and plumbago to the mould before casting, as suggested by Mairy, reduces the cooling rate, and promotes efficient heat-treatment.

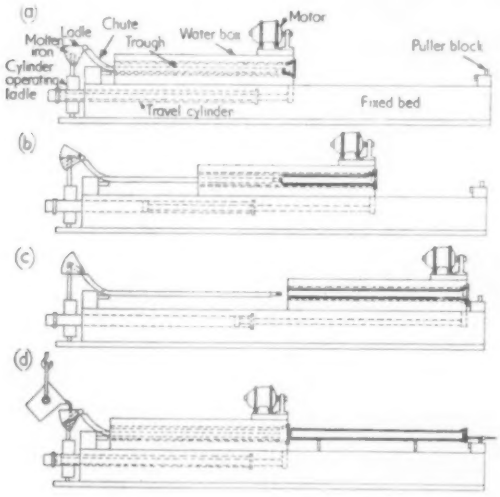


FIG. 2.—*(a), (b), (c), (d)—Schematic sketches illustrating the various stages for producing metal-spun pipes by the Stanton-De Lavaud-Mairy process. Note the long stationary-cantilever pouring-trough which delivers molten metal to the socket-end of the pipe at the commencement of pouring. Movement of the mould container from positions (a) to (c) distributes the metal evenly along the length of the mould. The return of the mould housing to the pouring station (d) withdraws the solidified tube.*

Operation

In this process, frequently described as the "metal spun method," a sand core is inserted in the socket end of the mould in order to produce the required internal socket shape. The mould container is moved to the top of the track and the mould is revolved by the electric motor provided. When the desired speed has been reached, the hopper begins to tilt, and the molten-metal supply is transferred at a uniform rate into the rotating mould. Owing to the slight angle-of-inclination, the liquid metal tends to fill the socket portion of the pipe, and when this is done the water-cooled mould assembly is withdrawn, travelling down the inclined track at constant speed. In this way a continuous spiral of liquid iron is deposited on the inner mould-surface, eventually forming a continuous metal pipe due to mould movement. When the specified time of rotation has elapsed, internal-grip tongs are inserted in the pipe, and the latter is withdrawn from the mould by moving the mould assembly up the track to the pouring station. The whole procedure may then be repeated and further pipes produced as required. Mould life is considerable, and may reach three or four thousand castings but is greatly influenced by individual pipe-size and the frequency of the pipe-production cycle. A limited amount of re-boring of used moulds is carried out. A normalizing and stress-relieving heat-treatment is usually applied to metal-spun pipes, involving heating to 880 deg. C. for 45 min. in a continuous gas-fired furnace. Finishing operations are restricted to internal cleaning, followed by hydraulic testing and the application of a protective coating.

This excellent method, originally perfected in this country by Fox and Wilson, has been adopted throughout the world as the principal technique for cast-iron pressure-pipe production. Plant installation and operating costs are substantial, and development work has proceeded in many quarters in order to secure lower production costs. Virtually-automatic pipe-spinning plants capable of substantially-increased output are now in existence. British Patent 752,833 refers to Belgian work, in which physical characteristics such as iron fluidity and temperature are continuously measured, and correlated with pouring speed, mould movement and rotation, and other factors, to secure automatic operation. German workers have adapted the original metal-spinning equipment to produce relatively-thick-walled tubes in ductile cast iron. A metallic mould, lined with ceramic, or water cooled, is arranged for production on De Lavaud principles. An important modification is that when the cast tube is stripped from the mould it passes immediately into a heat-treatment furnace, and then into a tube-rolling mill.

Sand-spun Pipes

In the sand-spun process, cast-iron cylindrical moulding boxes are used. The boxes are placed on-end and a cast-iron pattern placed in each; adequate location is provided in the base of each box, and moulding-sand rammed into the annular space left between the pattern and moulding-box wall. Pneumatic rammers are used and, after the pattern has been removed, the rammed moulds are air dried, then stove dried. Each dried mould is placed in a horizontal-axis spinning machine (Fig. 3) and rotated at the required speed. Molten iron is poured into the mould by means of a comparatively-simple runner-box-and-spout arrangement which is not so involved as that used in the metal-spun process. In the latter case, the liquid iron freezes rapidly when in contact with the metal mould and hence the cantilever pouring

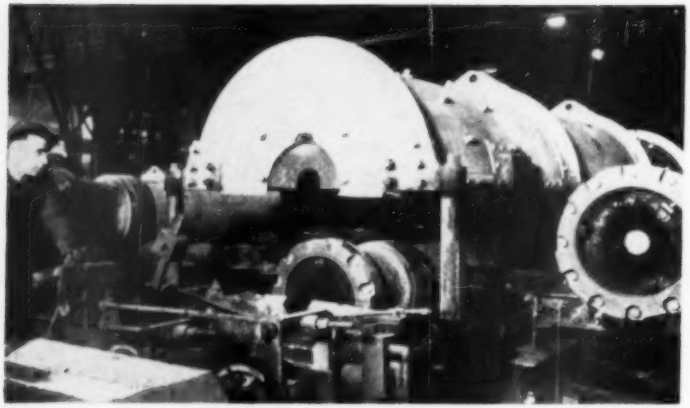


FIG. 3.—*The hood is being lowered over a rammed mould prior to the casting of a sand-spun pipe.*

trough is essential if molten metal is to be evenly distributed over the mould interior. Sand-lined moulds on the other hand reduce the cooling rate of any casting considerably, and the molten iron is easily distributed. The time of spinning is several times greater in sand-spun practice than when metal-spun pipes are made. Pipes up to 24-in. o.d. are produced by both the sand-spun process and the metal-spun method. Smaller sizes are more economically produced by the metal spun method, as an increased quantity of sand must be rammed into the average size moulding box in sand-spun practice.

Segregation

Some segregation is inevitable in centrifugally-cast iron pipes. Sulphides and graphite tend to migrate toward the inner sections of the pipe, while iron/iron-phosphide eutectic segregates toward the outside. It is likely that metal-spun pipes will be less affected than sand-spun pipes since the casting cycle and rotation time of the latter is much greater. Much will depend upon the mass of metal concerned, and such segregation is not serious in either product.

The sand-spun process has been adapted to the production of gun barrels, hollow shafting, rolls, and similar products, where maximum density and consistent properties are necessary. Moor and McKay have described the production of such articles in alloy steels, little variation being seen from the technique used for the production of cast-iron pipes, though details of mould material and metal casting-temperature are naturally different.

Mould Materials

The mould material used for cast-iron pipes is very-coarse-grade natural moulding sand, faced with a refractory wash, and the casting temperature is in the region of 1,250 to 1,300 deg. C. It is interesting to note that the usual moulding sand containing appreciable proportions of coal dust, which finds wide application in normal iron-foundry practice, is not used in centrifugal practice. When such sands are used gas generated as the molten iron reaches the coal dust apparently causes a cushion effect. Frictional effects which normally allow the molten iron to attain the requisite mould speed are reduced to such low levels that slipping occurs and the required tubular shape is not then obtained. Centrifugal steel castings require a more-refractory mould material, a mixture of silica-sand, fireclay and silica-flour bonded with water and bentonite being used. Resin-bonded sands are now occasionally used. The recommended casting-temperature is between 1,520 and 1,600 deg. C., and it seems that a controlled pouring speed is necessary. An orifice varying from 1½-in. to 3-in. dia. is recommended, depending upon the pipe diameter. The microstructure of centrifugally cast steel is similar to that obtained from a good sand casting, but the grain size is smaller and the physical properties obtained are superior to those found in statically-cast material of similar analysis. A limited amount of carbon segregation is experienced in centrifugally-cast steel; Dickson, Moor and McKay, and Northcott and McLean, have also reported such segregation. Since this occurs on the inner parts of the castings concerned, no appreciable ill-effects can be expected.

Rain-water Pipes

Rain-water pipes are made in very-large numbers by various sand-moulding techniques and statically cast. In recent years increasing labour and metal costs coupled with the introduction of alternative materials such as asbestos-cement and plastics, have stimulated interest in centrifugally-cast iron pipes. One established type of machine, which uses a refractory-sprayed metal mould for the jobbing production of tubular shapes is illustrated in Fig. 4. Morgan and Milnes have shown that the continuous production of rain water and soil pipes by centrifugal methods is a practical proposition and one British plant is now producing approximately 1,000 pipes per nine-hour shift.

Operation

The plant is designed to use many grey-iron moulds in turn, in order to secure a high output, while still maintaining the cooling rate necessary for pipes free from chill. It is not economic to apply heat-treatment to a low-cost product of this nature, but partially-chilled pipes tend to break readily and cannot easily be cut when required. Each mould is preheated, coated with refractory blacking and fitted with a socket core. The prepared mould is then transferred to a spinning machine and

when the required speed has been reached, molten iron is poured into the mould. Solidification is complete in a few seconds and the mould assembly is removed, de-cored, and allowed to cool until the casting has contracted sufficiently for stripping. The latter operation occurs in the next stage when the mould is released, and cleaned by a compressed-air jet. Each mould in turn follows this cycle and passes to a cooling chamber, before recirculation. The whole system is virtually automatic, each operation being closely integrated into the production cycle to maintain the high production which follows from controlled mould-temperature, pouring speed, and mould movement.

Two Metals

The flexibility of centrifugal casting methods is illustrated in the production of long tubular shapes in refractory-lined metal moulds. All ferrous and non-ferrous alloys for corrosion- and heat-resistance can be cast in this way and where two metallurgical characteristics are required in a single tube two dissimilar metals or alloys can be poured successively into a horizontally spinning mould. For example textile rolls of stainless steel cored with grey iron, or low-alloy steel pipes lined with abrasion-resistant iron can be made very economically. Plain carbon or alloy-steel shells made by centrifugal methods, which can be welded to sand-cast ends of suitable shape, are frequently used for retorts. The older type of cast-copper printing roller is now being supplanted by cheaper grey-iron rollers of lighter weight (Fig. 5), centrifugally cast and machined to close limits before copper plating. Horizontal-axis machines of the "free roller" variety originally developed for marine-engine cylinder liners are adapted for this work.

Cylinder Liners

An important part of the industry producing centrifugal castings on horizontal-axis machines is devoted to the production of cylinder liners and piston-ring pivots. Such castings are produced in permanent metal-moulds, and are relatively small when compared with the pipes previously discussed. Centrifugally-cast pipes and similar products are commonly made in lengths up to 18 ft., whereas cylinder liners rarely exceed 5 ft. in length, and the majority of such castings are less than 2 ft. long. During the period 1919 to 1923 the manufacture of these castings was pioneered in this country by Stokes. The process is carried out in

FIG. 4.—*Metal-mould machine for the jobbing production of iron rainwater pipes. Machine with mould removed showing the spinning shafts exposed (top left). Mould being treated with refractory spray prior to use (top right). Ready for casting with metal receiver and end screen in place (bottom left). Cast pipe partly extracted from the mould (bottom right).*

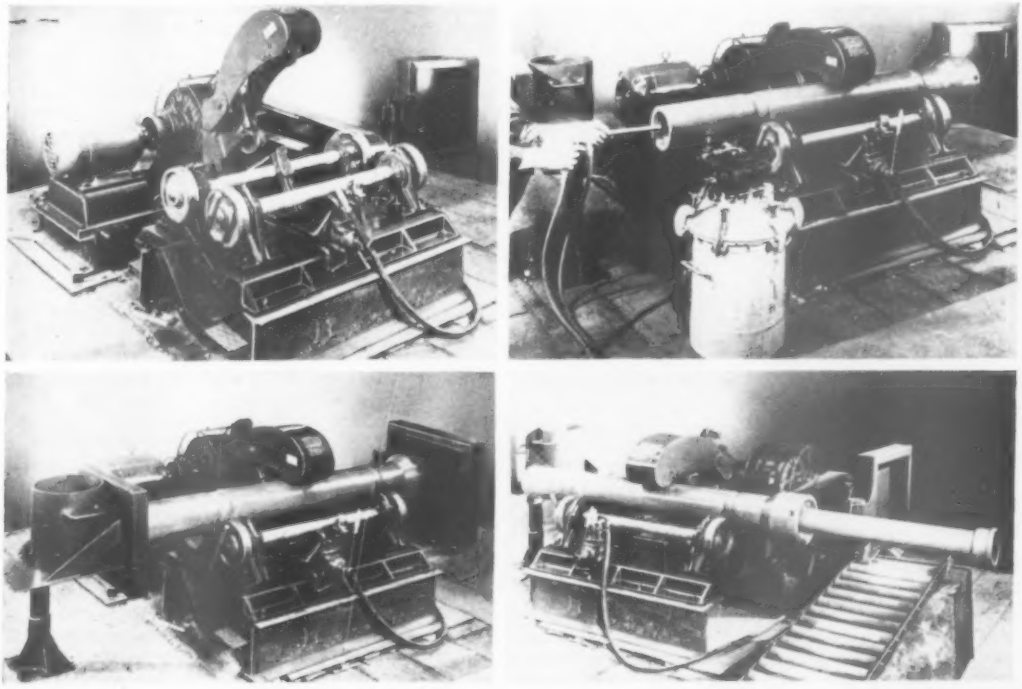


FIG. 5.—*Grey-iron centrifugally-cast printing roller to be subsequently copper plated. Less expensive, and not so heavy, this is now replacing the earlier cast-copper type.*

metal moulds maintained at a temperature approaching 600 deg. C., in contrast to the systems previously outlined, which utilize either water-cooled- or sand-moulds for cast iron. Bronze castings of a similar type are produced in metal moulds which are maintained at a maximum temperature of 150 deg. C. In cast-iron practice, a single mould is used in each machine and is maintained at the necessary temperature by the quantities of molten iron used in the process. When bronze castings are made a number of moulds are used and as each casting is produced in turn, the mould and casting are removed from the machine, being replaced by a fresh mould at the correct temperature. The various techniques are adopted for metallurgical reasons. Cast-iron pipes should be machinable, if necessary, and hence a chilled white-iron is undesirable. Heated moulds are used for cast-iron cylinder liners and piston-ring pots, in order to obtain a pearlitic structure, as some workers believe that under-cooled graphite, and the ferrite normally associated with this type of structure, is undesirable in piston-ring and similar applications. Bronze castings are produced in relatively-cool metal moulds in order to promote a fine-grained matrix, and the formation of small, well-distributed (α and δ) eutectoid. This structure has been proved to impart the maximum-wearing properties which are desirable in these products.

Machine Design

Many types of machine have been devised for this purpose, but most are similar to the original Stokes' design, and a description of the latter will therefore suffice. The casting machine is essentially a horizontal shaft supported on two bearings, fitted with a face plate and driven by an electric motor connected to the opposite end. A cylindrical cast-iron housing is attached to the face plate, and accommodates a cylindrical metal mould. An annular disc of iron or steel fits inside the housing, and is kept firmly in place against the end of the mould by a number of tapered cotter pins. The latter are driven into slotted bolts which are an integral part of the mould housing, extending beyond the annular disc. These pins are driven into the bolts in an anti-clockwise direction, and therefore tend to become even more firmly seated as the mould assembly gathers speed. The diameter of the hole in the metal disc controls the bore dimensions of the casting if excess metal is transferred to the mould. Several mechanical methods for the application, holding and removal of the face plate are established.

Molten metal is handled by a casting machine, which consists of a wheeled carriage mounted on rails. The carriage bears a metal ladle, essentially a shallow dish-shaped container lined with refractory, and having an extended-tubular metal runner slit longitudinally to facilitate pouring. In practice, the machine is started, and the mould assembly allowed to reach the desired speed. A known quantity of molten metal is transferred to the ladle, and the carriage moved forward until the tubular runner is projecting inside the rotating mould. The operator turns a hand-wheel which is geared to the ladle, and the latter is tilted, enabling the liquid metal to flow along the tubular runner and hence through the slot. Metal transfer is rapid, and a tubular casting is produced in about five minutes. The empty ladle is removed from the mould and cleaned in readiness for the next casting cycle. When the appropriate time has elapsed, the rotating mould assembly is stopped by cutting-off the power supply and using the brake system provided. The casting is then extracted by internal-grip tongs. In another type of machine, ejection is secured by means of a ram located in one end of the mould. This system ensures more-positive casting removal than may be obtained with grip tongs, especially when the mould is overheated. Casting surface finish can be impaired by forcible ejection when the inner surfaces of the mould are poor; small defects in the mould can become more-serious grooves or scratches on the casting outer surfaces.

Yield

Cylinder liner and piston-ring pot castings are unique in that no orthodox running and feeding system is used and the ratio of casting weight to weight of metal poured is therefore quite high, yet the machining allowances needed are also quite high by ordinary engineering standards. Castings of thinner section and of equal soundness cannot easily be made by the established methods and the substantial machining allowances used are essential. Since 1893 several workers have suggested that thinner sections might be cast if the metal stream could be distributed more rapidly around the mould interior, but a satisfactory method has not been available until recently. British Patent 849,751 refers to a novel technique in which the metal is poured into a refractory-lined container which is then automatically clamped to the mould (Fig. 6). Mould and container are rotated rapidly in the

vertical plane, causing the molten metal to rise into the mould as the speed of rotation increases. This arrangement secures smooth and steady entry of the metal into the mould, erosion is reduced to a minimum in this way and good metal distribution free from turbulence is ensured. The mould

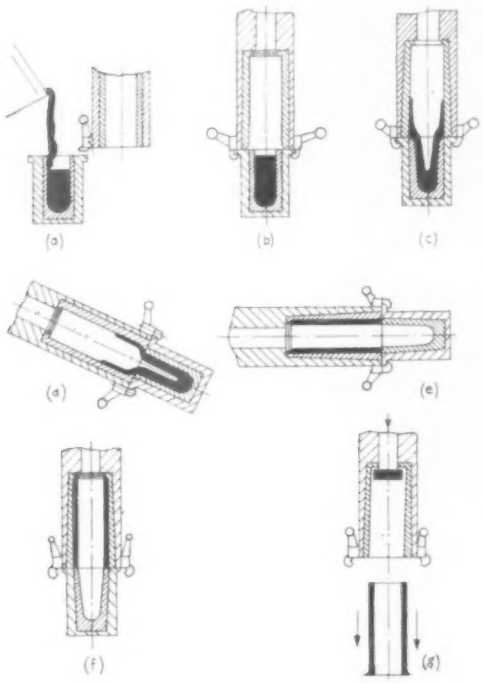


FIG. 6 (*a.-g*).—*Schematic sketches of a patented method for producing cylinder liners in which the metal-transfer cylinder and the mould are spun as one unit to achieve a smooth and uniform metal distribution. (a) Metal being poured into container. (b) Container moved into position below mould, and both clamped. (c) Container spins, causing metal to rise into the mould. (d) Mould assembly is tilted while rotating and container emptied. (e) Assembly in horizontal position while liner casting solidifies. (f) Assembly returns to vertical position, rotation stops, container is unclamped and removed. (g) Liner casting is ejected and cycle is repeated.*

assembly is tilted while still spinning and brought into the horizontal plane; all metal is thereby drained from the container and the mould filled before solidification begins. When solidification is complete, the mould assembly is returned to the original inverted position to facilitate casting ejection. Ported liners and other cored castings may also be made in this way.

Despite the apparent simplicity of centrifugal castings production, skill is needed to produce high-quality material, and various devices have been used to enable several machines to be serviced by the minimum number of skilled personnel. In the patent described a quadruple-mould single-station machine (Fig. 7) designed for automatic operation is provided, which needs one man only to pour the molten metal, and to start the sequence of operations. This system is one of considerable potential for low-cost, high-speed production.

Large Centrifugal Castings

Extremely-large castings are occasionally produced on horizontal-axis machines, and bronze and steel castings weighing more than 20 tons, measuring up to 48-in. dia. and 30-ft. long, are made in this country. Refractory-lined steel moulds are used and the complete charge poured very quickly. Such products are used for paper-making machinery and chemical plant.

Ingots

Simoneit and Radeker have described the production of very-large steel ingots for high-pressure boiler drums. Such ingots may be made hollow in order to facilitate the subsequent forging operation. British practice consists in the static casting of large solid ingots, which are later bored and forged into shape. Normal piercing and drawing processes are limited to comparatively-small ingots, and very-large tubular products cannot readily be obtained by such techniques. It has already been established that cylindrical ingots cast by static methods may not be obtained in a wholly-sound condition; segregation becomes a problem in very-large solid ingots owing to the time factor involved in solidification. The multiple-sided ingots which are usually cast are liable to prove expensive, since the yield is low, and machining cost high.

In German practice, hollow ingots are sometimes made by centrifugally casting the required amount of metal in a horizontal-axis mould. The latter should be made of haematite cast-iron or be of water-cooled steel construction. Molten metal is introduced into the rotating mould by means of a refractory-funnel arrangement, and mould erosion prevented by a prior addition of dry sand. The latter is added in sufficient quantity to form a layer 5-mm. thick on the inner face of the rotating mould; this technique is originally American though used much more in Germany. Details of various methods used to produce large steel ingots are given in Table 1 and afford an interesting comparison. It will be seen from the figures quoted that considerable economies are possible, when centrifugal methods are used to produce large ingots.

Bearings

An unusual variation on normal centrifugal practice is that adopted in one British plant manufacturing steel-backed copper/lead bearings for diesel engines. In contrast to normal practice, solid rods containing 75 per cent. copper, 24 per

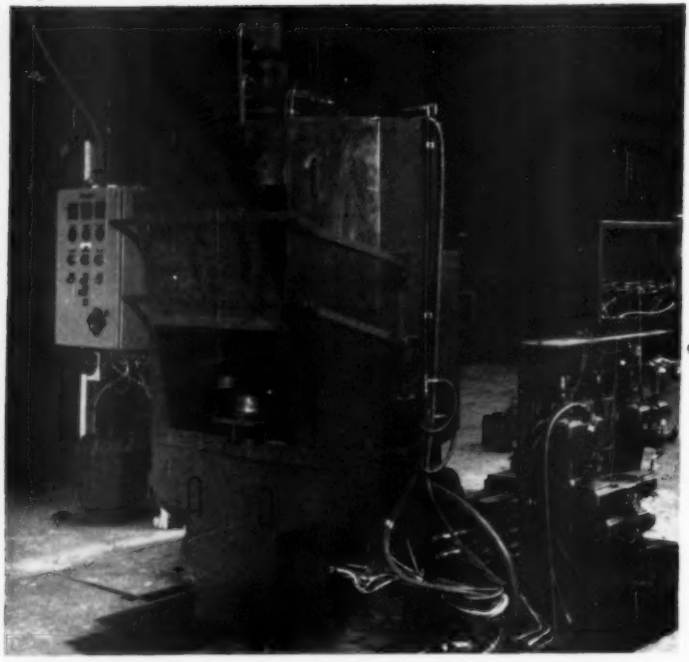


FIG. 7.—*Machine for the automatic production of liner castings.*

cent. lead and one per cent. tin are milled to provide swarf which is weighed and rammed into thin walled mild steel containers. The swarf is compacted into an annular lining by a pneumatically-operated plunger and the lined container is then transferred to a horizontal-axis centrifugal-casting machine. While supported on a heat resistant steel mandrel in the machine, the assembly is spun at a selected speed, and simultaneously heated in a 25 kw radio-frequency coil. When the charge is melted, the container is withdrawn and rapidly quenched in water sprays. The cycle is completed in six to eight minutes, producing a casting which can be parted into three rings, each one finally becoming a pair of bearing half shells. Copper/lead alloys having a desirable structure are notoriously difficult to produce in cast form, but those made in this fashion have given excellent service in many applications.

TABLE 1.—*Ingot-production Methods.*

Ingot type.	Solid 8-sided ingot.	"Slush cast" 16-sided ingot.	Cored ingot.	Centrifugally-cast ingot.
Ingot size ..	6 to 7 ft. dia. 20 ft. long including feeder	6 ft. dia. 14 ft. 6 in. long	6 ft. o.d. 3 ft. 8 in. i.d. 17 ft. 4 in. including feeder	5 ft. 10 in. o.d. 3 ft. 3 in. i.d. 14 ft. 4 in. long
Weight of metal cast	145 ton	92 ton	75 ton	57 ton
Final product ..	45 ton	5 ft. 10 in. o.d.	3 ft. 10 in. i.d.	13 ft. 8 in. long
Percentage recovery ..	31	49	60	79

Vertical-axis Castings

Comparatively-simple components such as gear blanks are produced in large numbers on vertical-axis machines. More intricate-shaped castings are also made in this manner. The interior of castings produced on horizontal-type machines is cylindrical in shape. The cavity formed in castings made on either vertical-axis or inclined-axis machines is not cylindrical, being controlled by the angle of the axis-of-rotation. As the latter is increased the casting bore becomes tapered, finally assuming a parabola shape when the axis of rotation reaches 90 deg. to the horizontal plane. Some variation is obviously possible in the internal shape of castings not produced on horizontal-axis machines, and such differences are responsible for the somewhat loose nomenclature which has been adopted in the industry.

Terminology

Terms such as "centrifuging" and "semi-," "true-" and "simple-" centrifugal castings are not precise. Two main techniques may be distinguished in general practice; they are, that in which liquid metal or alloy is poured into a rotating mould, and another in which a stationary mould is filled with molten material before subsequent rotation. The centrifuge is a well-known piece of laboratory apparatus and is invariably filled before rotation. It may be convenient, therefore to regard centrifuged castings as those which are produced by the rotation of any mould when the latter has been filled prior to rotation. All other castings made in rotating moulds may conveniently be described as centrifugal castings. Optimum properties are obtained from the latter since centrifugal force is used to the best advantage. In certain cases, if the mould-material used is liable to be attacked by the liquid alloy, it may be useful to allow a protective layer of solid material to form on the mould wall before rotation begins.

Mould Materials

Sand or metal moulds may be used, depending upon the intricacy of the castings concerned. Sand cores can be used in relatively-simple metal moulds to obtain additional detail if required, and metal

moulds may be machined internally to provide corresponding casting profile. Grey cast iron is the most popular metal mould material, although alloy steel and aluminium/bronze moulds have been used. Graphite moulds have found useful application, though the latter is limited by the tendency of graphite to oxidize at normal casting-temperatures. An oil-bonded sand of high dry-strength finds wide application for sand moulds used in vertical-axis centrifugally-cast work. The greater flexibility of the sand moulding process controls its application, and this feature is of great value when intricate castings are made. Metal moulds are used whenever the design and quantity factors are favourable.

The products made on vertical-axis machines range from grinding balls for ore-crushing equipment, to steel gears, small marine propellers, and automobile crankshafts. Extremely-small centrifugal castings in gold, platinum or nickel-base alloys have been used in dentistry for many years, very-fine-grained refractory mould-material is essential in the production of such castings; large numbers of tin-base castings for jewellery are centrifugally cast in rubber moulds. Large castings such as tank-turret covers, and steel spur-gear rings for gun mountings were regularly produced between 1939-45. The latter castings measured 7 ft. in dia. and were produced in pairs by stack-moulding methods. Such methods can easily be adapted to vertical-axis technique, provided that great care is taken to locate accurately each mould part in turn. High yields are obtained by stack-moulded centrifugally-cast methods.

Mould Arrangement

Armitage has shown clearly how valuable centrifugal techniques can be when allied to stack moulding and ceramic moulds. The wax patterns assembled in Fig. 8 are excellent examples of such work. The running-method used in vertical-axis work is dependent upon the design of the casting involved. Ring shapes are easily made by simple top-pouring methods, molten metal being distributed evenly around the inner-mould wall during rotation, and the required wall thickness obtained by controlling the quantity of metal added. Small and relatively-intricate-shaped parts may also be poured on vertical-axis machines. The requisite mould cavities are disposed symmetrically about a central running system, so that the former tend to assume a continuous outline similar to the rim of a wheel; the ingates in the running system may be regarded as wheel spokes, which are fed in turn by the hub or central down-runner. A pressure-feeding effect is obtained during mould rotation and the shrinkage normally occurring should be confined to the runner system. Solid or cored castings can be produced in this way (Fig. 9). The potential of vertical-axis methods when applied to normal oil-sand or sand-cement moulds has been repeatedly demonstrated. A notable example is the elegant arrangement for centrifugally casting lengths of chain, which is due to Ronceray.

Precautions

Certain precautions are necessary during centrifugal casting operations. Very-large stresses are set up during the high-speed rotation frequently employed in this process. Sand moulds should be adequately reinforced with steel retaining boxes; both sand- and metal-moulds should be securely attached to the rotating mechanism. All moulds which are rotated should be provided with adequate splash-guards, although overfilling of centrifugal moulds should be prevented by careful estimation of the liquid metal involved. As the latter is generally measured on a volume basis, overheating should be avoided. The recognized disadvantages attached to overheated metal when statically cast, apply equally to the centrifugally-cast product, and the additional grain-refinement found in the latter material will absent if overheated metal has been used. Down runners should be comparatively long, in order to reduce the possibility of metal ejection when a filled mould is rotated at high speed. Much defective centrifugally-cast material is due to incorrect-spinning technique. Vibration may readily occur in centrifugal casting equipment unless due attention is paid to maintenance. Northcott has pointed out that banded structures may be due to vibration of the mould assembly as the casting solidifies, coupled with the existence of a steep temperature-gradient.

Speed of Rotation

It is desirable to use the minimum speed of rotation in every case, in order to secure maximum output. Excessive speeds are uneconomic, since time is expended in reaching such speeds, and in braking when the casting cycle is complete. If the minimum speed is not reached, droplets of liquid metal are detached from the mass, and an inferior casting is obtained. Excessive speed of rotation

FIG. 8.—*Typical assemblies of wax patterns for vertical-axis centrifugal casting illustrating the adaptability of this method to stack moulding.*

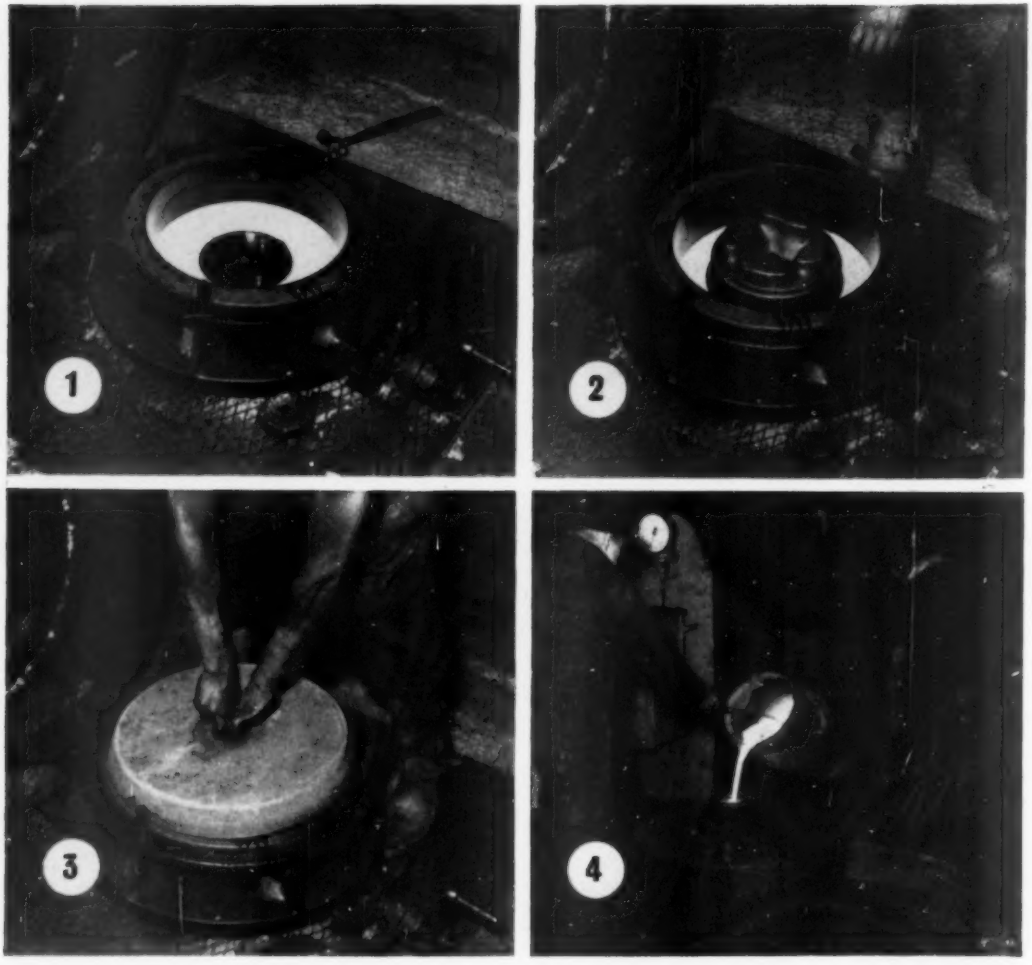


FIG. 9.—*Main sequence of operations for producing vertical centrifugal castings.* (1) *Outer chill with asbestos paper lining in the bottom of the mould.* (2) *Runner-core placed in position.* (3) *Top core being set.* (4) *Pouring into the rotating mould.*

increases the internal pressure to which the casting is subjected and the material will be prone to cracks or tears. The speed of rotation is normally inversely proportional to the casting diameter, and the optimum speed for any casting may be calculated in several ways, the principles involved having been discussed by many workers. These calculations are based upon several factors, and do not take into account other points of equal importance. Northcott, and other workers, have shown that the effects of slip between the mould surface and the outer layer of molten metal must influence the speed of the latter. Northcott has also shown that the metal may only attain the same speed as the rotating mould when the increased viscosity, due to temperature decrease, results in an increased force being applied. Donoho is in agreement and also states that the "times gravity" factor can be less for cold moulds, than for hot moulds or sand moulds. A mould-spinning speed sufficient to give 75 G is frequently used in horizontal-axis work.

In practice, castings are allocated for production according to size and weight. Some tolerance is apparently permissible in the speed of rotation and for many alloys only three principal speeds may be required to produce the majority of castings in vertical-axis machines.

Segregation

Bearing-shells are often lined with tin-base whitemetals by centrifugal methods though precautions are necessary to prevent the segregation which tends to occur when an unsuitable spinning speed is used. When such alloys are cast Cu_6Sn_5 needles are precipitated first, followed by cuboids of antimony/tin compound, and finally the tin-rich matrix becomes solid. The copper-rich compound is heavier than the liquid, at high-spinning speeds tending to collect in the areas adjacent to the bond between shell and whitemetal lining and is therefore a potential source of weakness. The lighter antimony/tin compound tends to segregate

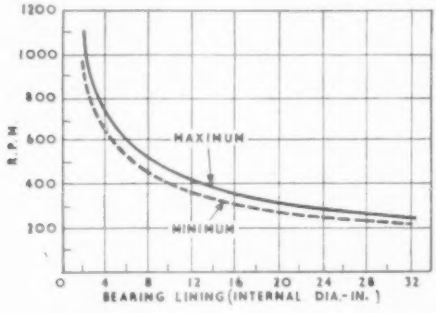


FIG. 10.—*Critical spinning-speed limits related to inner diameter of the shell for the casting of tin-based whitemetal to prevent detrimental segregation.*

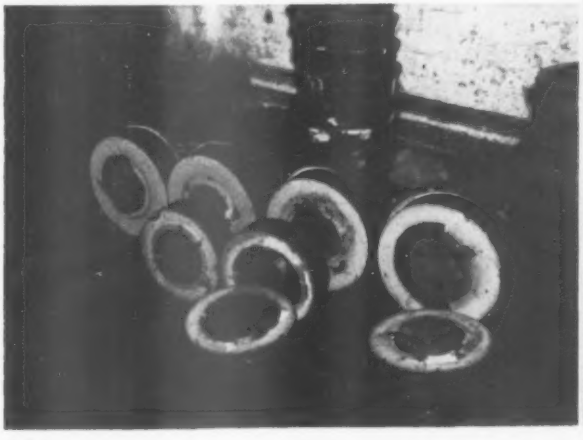
near the inner cast surfaces and may be lost during machining. Clenny has shown that segregation can be minimised if the maximum and minimum spinning speeds illustrated (Fig. 10) are observed. The shell- and pouring-temperatures used are obviously both of considerable importance also, since they will directly influence the solidification time.

Camshaft Bearings

An unusual technique for the production of centrifugally-cast white-metal-lined camshaft bearings where the shell is spun and the whitemetal remains relatively static, is practised in one plant in the US; steel tubing is descaled in molten caustic-soda, washed and pickled in acid to secure a clean etched surface suitable for bonding. A 5-ft. length of tubing is lowered into a deep pot of whitemetal, the tubing is then spun at a selected speed, and withdrawn vertically from the whitemetal bath. A cooling jet of moist air is directed on the outer surface of the tubing during withdrawal; the speed of rotation and withdrawal, and the quenching-rate used all contribute toward a controlled lining-thickness. The lined tubes are then cut and machined to size.

Continuous casting and centrifugal casting are both acknowledged to approach the ideal in metal-forming technique and many workers have sought to combine the two. A Belgian company has patented a method and equipment for this purpose. In British Patent 817,847 two circular cooled-moulds are arranged horizontally so that the annular space between the two is continuously filled with liquid metal during rotation; an external holding unit is provided for metal supply and is designed to pressure-feed metal between the two moulds. The speed of rotation is also claimed to influence the rate of metal supply. As in conventional equipment for continuous casting, relatively

FIG. 11 (*left*).—*Centrifugally-cast bronze worm-wheel blanks produced by Leyland Motors, Limited (see also Fig.* 1). FIG. 12 (*right*) *shows a finished worm-wheel gear being tested with a master worm-gear shaft.*



Centrifugal Casting

short moulds are used and provision made to regulate the extraction rate. The equipment used for the latter purpose is obviously more complicated however, since it must also accommodate the rotary movement of the cast material during extraction. Mould-lubrication difficulties are clearly possible in an arrangement of this nature, and the later B.P. 827,262 refers to the application of a ring of high-density molten metal or alloy between the cooled mould and the tubular casting during solidification. Metals of low melting-point and relatively-high boiling-point which are insoluble in the alloy being cast are recommended; an ingenious device is provided to recover and re-circulate the lubricating metal or alloy as it emerges from the mould with the tubular casting. Equipment for the vertical-continuous-centrifugal casting of alloys has also been patented.

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[10] Centrifugal Casting Calculations. R. F. Wood. *Metal Ind.* (N.Y.), 1925, **33**, 491-6.
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[12] Spinning Speeds of Centrifugal Casting Machines. P. G. Carrington. *Trans.* American Foundrymen's Assoc., 1944, **52**, 333-48.
[13] Geisler. *Proceedings* Institute of British Foundrymen, 1938-39.
[14] Ronceray. B.P. 664,093.
[15] Clenny. *Iron Age*, 1947, **62**, 160.
[16] Morgan and Milnes. *British Foundryman*, May, 1959.
[17] Foundry Equipment, Limited. B.P. 849751.

Miniature Cupola Handed Over

The photographs below were taken at the handing-over ceremony of a new model cupola furnace to the Accrington College of Further Education which took place on March 21 at the College. The furnace was made and erected by the apprentices of Newton, Chambers & Company, Limited, Sheffield, and presented for use by the College students.

The furnace was formally handed over to the chairman of the College Governors, Alderman W. Brotherton, by Mr. Goodhind, personnel manager of Newton, Chambers & Company, Limited. Also present at the ceremony were Mr. Norton, Mr. Pinder, and Mr. Curry, training officers of the Sheffield firm; the board of Governors of the College; Mr. S. R. B. Swan, principal of the College, and representatives of local industry.

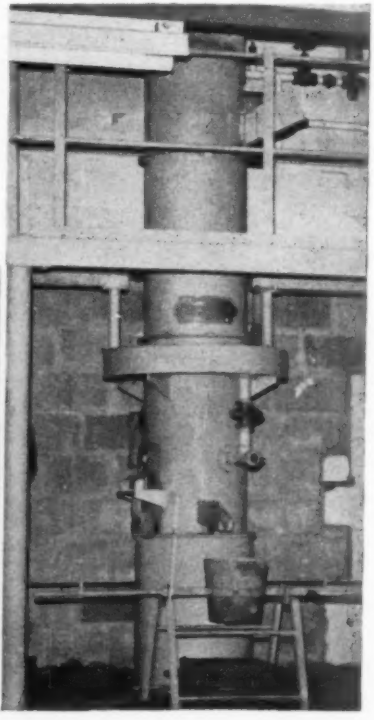

FIG. 1 (*right*).—*Miniature cupola furnace 12-in. i.d. as erected in the Accrington College of Further Education and ready for use. The furnace has a monolithic lining and is capable of melting 8 cwt. of cast iron per hr.* FIG. 2 (*below*).—*Actual handing-over ceremony with Mr. Goodhind (back to the camera) making the formal presentation to Alderman W. Brotherton, chairman of the College Governors. Mr. S. R. B. Swan,* M.ENG., A.M.I.MECH.E., *is on Alderman Brotherton's left, and also present are other Governors and some students of the College. (A similar cupola, also made by Newton Chambers' apprentices, was installed at Rotherham Technical College earlier this year.)*

National and Midland Ironfounders' Association

Market Development Plans discussed at Annual General Meeting in Birmingham

The annual general meeting of the National and Midland Ironfounders' Association was held in Birmingham on the afternoon of March 23 at the Queen's Hotel. It was attended by about 65 representatives of member-firms and followed a luncheon of members and guests in the same hotel.

Mr. W. James (of Monmer Foundry, Limited), the chairman, directed the proceedings and first of all gave a welcome to members and particularly to Mr. W. H. Thursfield, their president. After formal business had been disposed of, Mr. James presented his annual report on the Association's activities from which the following has been culled.

CHAIRMAN'S REPORT

The chairman began by quoting "'Tis all a chequerboard of nights and days where destiny with men for pieces plays" (Omar Khayyam) to describe the business life of our times. He went on to say that tribute to the ironfoundry industry had recently been received in the Daily Press and could be quoted as further proof that at last the gloomy mentality of an "inferiority complex" had been replaced by a countrywide belief in the importance of ironfounding as one of the indispensable major factors in the economy of industry. In spite of a levelling-off operation in the motor industry, the chairman said that the ouput of grey-iron castings had increased to give for the fourth quarter of 1960, an annual rate of four million tons. The production of iron castings for the fourth quarter of 1960 amounted to 1,024,700 tons, and for the whole of 1960, he said the UK ironfoundry industry had produced the greatest tonnage of castings in its history. This record output of castings had been obtained in spite of the continued shrinkage in the number of foundries in operation, he added. During 1960, official figures disclosed that 43 foundries had ceased to operate and the total closures during the ten-year period—1950 to 1960—amounted to 435. On the other hand, the chairman stated that employment in the industry had increased by nearly 4,000 during the last year, and this implied that the output per individual foundry, and quite possibly the output per operator, had both increased.

Raw Materials

Discussing the raw-material position, Mr. James referred to the supply position and price variations during the period. Dealing with scrap, he said that so far as the NMIA was concerned, with territory covering the largest scrap-consuming area in the country, members might give thanks to the Midland Scrap-iron, Steel and Metals Association for helping them to produce a record output. Mr. James said the question of costing had always received great consideration and care was taken to present to members of the Association as a whole a true picture of the situation, leaving it to individual members to review their own position in relation to their particular problems.

Other Matters

Mr. James mentioned the retirement of Mr. Scales during the past year, and announced that Mr. Darville and Mr. Hallett had asked to be omitted from nominations for next year, and on behalf of the Association, he offered them thanks for their assistance and wished Mr. Scales a pleasant retirement.

Mr. James next dealt with the annual accounts of the Association and mentioned that the value of careful financing had become apparent now that the important subject of market development was arising. Official recognition, as well as financial support, for market-development proposals had been offered by both the Council of Ironfoundry Associations and the Joint Iron Council and subject to the constituent associations (including the NMIA) being willing to provide similar financial help, the whole scheme would become effective immediately. An appointment of an executive officer to operate the project had already been considered by the CFA and Mr. James said that full details concerning *modus operandi* would be available soon. Financial requirements of the scheme and the recommendations of the Executive were also dealt with at this juncture and Mr. James expressed thanks to the Association's publicity committee under the chairmanship of Mr. E. C. Marsland.

The chairman said also in his Report that local authorities continued to look warily on the industry as a contributor to atmospheric pollution, but a much better relationship now existed between them and a spirit of co-operation was being established. Foundry amenities and safety regulations were a "constant" in good management, but Mr. James said that if further demands were made in this direction, the Safety Committee of the CFA (on which the Association was represented by Mr. W. Trafford) would continue to advise and recommend. The chairman said that the Association had been very well served by the secretariat during the past year, and he paid tribute to the work of Mr. Sims and Mr. Rogers and their staff. Finally, Mr. James said they were still in the iron age—the cast-iron age—and the progress which had been made in the production of special-quality iron had in fact greatly extended the field of use for cast iron. In this connection, he said the work of the British Cast Iron Research Association had been invaluable and close contact with them would be continued by the Association's Development Committee.

NMIA Annual General Meeting

Liaison Work

Reporting on the Association's relations with the Council of Ironfoundry Associations, Mr. E. C. Marsland (Repton Foundry, Limited) claimed that it was the NMIA that had taken the initiative on market research and development amongst the associations and then introduced Mr. A. C. Jones (Izons & Company, Limited) to give details of liaison work. Mr. Jones listed the subjects on which work had been done during the year in co-operation with the CFA and quoted the officials responsible. He also referred to the forthcoming "Code of Safe-working Practices" which the education committee of the CFA were working on.

The next items on the agenda dealt with annual subscriptions (to be the same as in the previous year), accounts (which were adopted without division) and a report on the National Foundry Craft Training Centre. In the latter, it was stated that the overall target of £100,000 towards rebuilding the Centre had been split into two initial projects involving £50,000. Towards this sum, £23,000 had already been contributed and at the meeting, then current a further donation of £500 was voted by the NMIA.

MR. HALLETT'S ADDRESS

Continuing the proceedings, the next most important item was an address by Mr. M. M. Hallett, M.SC., who is *inter alia* chairman of sub-committee 7A (market research) European Committee of Foundry Associations, and a member of the CFA market development committee. He reported on an 18-month survey carried out by the CFA for the Iron and Steel Board on prospects for the ironfounding industry up to 1965 and referred briefly to findings of the European committee set up to survey markets for the foundry industry as a whole.

First, Mr. Hallett drew a graph to present the trends of total foundry production over the last 15 years, taking the outputs for 1954 as criteria. Up to this date, there had been fairly steady post-war increases in all sections of the foundry industry of Europe. From 1954 onwards, ironfoundries production had begun to drop and had lost more foundry in the trade recession than had other foundry sections, though in 1960, iron had recovered somewhat, Mr. Hallett said. Steelfoundry production had fared worse than iron and aluminium founding was better, but not so markedly better since 1954. Zinc-base alloy castings, however, had shown the most spectacular and consistent progress over the last 10 years.

This pattern of results, Mr. Hallett continued, was typical throughout Western Europe; German and Italian production was still going up at a quite rapid rate, despite the cessation of war-damage effects. The ironfoundry position was not too bad and in fact output was still going up and the forecast for 1965 was a continuance of this upward movement.

A large part of the work of the European Committee to which he was attached, said Mr. Hallett, was to examine output trends in detail and to find if, where and why ground was being lost. Surveys had shown that iron castings production was increasing in two major fields, (*a*) the automobile field—where increases were expected to continue at least until 1965; and (*b*) the ingot-mould field. Minor increases were expected also in less-important classes, for example, road-making and agricultural machinery. The committee considered that increased *customer* activity, rather than any efforts on the part of ironfounders, would be responsible for the greater tonnages expected under the above headings.

At the same time, the committee expected decreased activity for ironfounders in the production of castings for pressure pipes, railways, ships, steam generation and domestic equipment. The reasons for this were mainly technical, and might result from cases where iron would not do a particular job perhaps so well as other materials coming along.

Technical Competition

Elaborating on reasons for technical competition that ironfounders were meeting, Mr. Hallett said the question had been posed "Why would people choose materials other than cast iron?" The main answers were (*a*) if the reputation for iron castings for quality and reliability were to fall, (*b*) if delivery promises were not adhered to. Price, it appeared, was of less importance than other factors—taken on a whole. The speaker then quoted a number of other hints for the guidance of founders in competition with other materials as follow: (1) All sections of the ironfoundry industry must be vigilant in maintaining quality and reliability of product because at present wrought material (forgings) sometimes enjoyed a better reputation; (2) quality was just as important as delivery; (3) bad suppliers could injure the whole industry, and (4) founders should try to reduce weight per component by improving design and production methods.

Technical Aspects

Asking the hypothetical question "What can we as an Association do about the present position?" Mr. Hallett said there were two spheres in which Associations could sway their members—namely, technical and commercial.

In the technical sphere, the body most responsible in the United Kingdom for promoting casting quality was the British Cast Iron Research Association and Mr. Hallett mentioned the particular grades of membership of BCIRA which were available.

Especially he stressed the advantages of B-grade membership, saying that the very small percentage of a firm's wage bill spent on a membership fee was the best possible investment a firm could make. Yet only half NMIA members were grade A, that is, free-members of the Association and only a quarter were B-class members. (Here, Mr. Hallett read testimonial letters from foundries reporting

on the practical value of BCIRA help, for example, on methods of ensuring soundness of castings.)

Commercial Studies

On commercial aspects, Mr. Hallett said the main losses to ironfounders had been in engineering fields. Selling was becoming more and more a technical job and an ironfounder's sales representatives should be able to talk to customers on casting service problems. If this were outside the competence of individuals, the CFA would shortly be able to supply data through its market-development officer whose appointment was imminent. This senior executive would become operative from mid-June and available for co-operation with founders on their selling and marketing problems. An advantage was that he would himself be an engineer and thus able to talk in the customers' own "language." It was certain that as time went on the selling world would get harder and harder for castings producers and more and more technical. Thus it was necessary to have a national armoury of facts available.

However, having a national development officer for the industry would not except individual founders from responsibility. Here, Mr. Hallett quoted the German example in this field, both in setting up a "fountain head" and in stressing individual's necessary contribution. It was a case of spending money in this way or fading out, he concluded.

Cost

The next item on the agenda was to consider NMIA contributions to market-development work and the CFA and here it was proposed that from the local association members a sum of £1,000 per annum over the first three years, was required, it being expected that the total of the NMIA share could be made up from normal revenue. To raise this, a levy of 10 per cent. on members' annual subscriptions was suggested as a basis for the three-year period. Mr. Hallett stressed the need for members to regard this as an initial stage of a long-term plan, despite the initial setting of a three-year programme.

Mr. E. Hunter, vice-president of the Association, supported the chairman in putting the revenue collection proposition to members and it was carried practically unanimously.

Election of Officers

The formal election of officers of the Association for the ensuing year was then proceeded with, resulting in the following becoming officers or being confirmed in office:—As *chairman*, Mr. E. Hunter (Court Works, Limited); as *vice-president*, Mr. E. C. Marsland; as *executive committee members*, Mr. W. James, Mr. K. G. Siddons, Mr. A. C. Jones, and Mr. G. E. Lunt were re-elected, with the addition of Mr. H. Page (of Chamberlin & Hill, Limited) elected in place of Mr. Hallett who resigned. The *auditors*, Camp, Ravenscroft & Company, were re-elected, as was the *secretary*, Mr. F. W. Sims (of Heathcote & Coleman). Mr. W. H. Thursfield (Izons & Company, Limited) was confirmed in office as *president* and congratulated from the chair on his continued interest and help in the affairs of the Association. A vote of thanks to the chairman and Mr. Hallett, warmly accorded following a proposition of Mr. Marsland, concluded the meeting.

Reciprocal Presentations

The thirty-fifth anniversary of both the chairman, Mr. C. J. Lake, and the managing director, Mr. C. H. Kain, joining the firm of Lake & Elliot, Limited, Braintree, Essex, was celebrated last month at the Savoy Hotel, London. In the illustration below Mr. Lake and Mr. Kain are seen presenting each other with gold watches—the usual award of the company to employees attaining 35 years' service.

British Standards Institution

BSI News for March lists under new standards issued, Part 2 of BS 3146, Investment castings in metal; part 2 deals with high-alloy steels, nickel and cobalt alloys (8s. 6d.). Another new standard is BS 3333: 1961 Pearlitic malleable-iron castings (4s. 6d.). Under revised standards there is BS 2789:1961 Iron castings with spheroidal or nodular graphite (5s.). Copies of the standards may be obtained from the sales branch of the British Standards Institution, 2, Park Street, London, W.1.

THE PROCEEDINGS of the fourth Soviet conference on "Electrochemistry" will be published this month by Consultants Bureau, Enterprises, Inc., 227 West 17th Street, 11, N.Y., in complete English translation. The conference heard reports on the latest Soviet progress in the field of electrochemistry and the full texts of the most important papers presented were published in the USSR by the Academy of Sciences USSR Press in 1959. The Consultants Bureau cover-to-cover English translation will appear in three volumes of approximately 300 pages each. Each volume is priced at $15.00, with a $40.00 price for the three-volume set. Complete tables of contents are available upon request from Consultants Bureau.

Notes from the Branches

London

Approximately 100 members (and guests) of the London branch of the Institute of British Foundrymen attended the meeting on March 22 at the Constitutional Club, Northumberland Avenue, London, W.C.2. The lecturers for the evening were Mr. W. B. Lawrie, M.B.E., M.Sc. (HM Engineering Inspector of Factories, Ministry of Labour, and a member of the Joint Advisory Committee on Conditions in Iron, Steel and Non-ferrous Foundries), and Mr. E. Ayres (director, Millspaugh, Limited, and a member of both the Technical Subcommittee and Main Committee of the Joint Standing Committee for Non-Ferrous Foundries).

Before calling upon the lecturers to give their talk, the London branch president, Mr. D. A. C. Hutchison, welcomed first Mr. H. Woods (Deputy Chief Inspector of Factories) to the meeting, saying how gratified the branch was that he was able to come along. Mr. Hutchison, before calling upon Mr. Woods to address the meeting, also welcomed Mr. P. B. Higgins (managing director, Yorkshire Engineering Supplies, Limited, and past-president, Association of Bronze & Brass Founders) and Trade Union representatives of the Joint Standing Committee on Safety, Health and Welfare Conditions in Non-Ferrous Foundries. Also present and welcomed to the meeting were Mr. J. G. Dick and Mr. R. E. Moore, both from Canadian Bronze Company, Limited.

In his remarks, Mr. Woods expressed approbation for what the foundry industry was doing to improve conditions in steel, iron and non-ferrous foundries. The co-operative work between the foundries and the Ministry was much appreciated, he said, and was used as a basis of what was practical for introduction to the Foundry Regulations, but he didn't want to elaborate on this theme at that juncture.

Often when discussions arose as to ways and means of improving conditions in industry, what appeared to be a burden might turn out to be a blessing—improving efficiency ultimately. Seeking efficiency was not necessarily opposed to measures for inculcating safety and welfare for employees. This was particularly true, he thought, of the non-ferrous foundry industry in relation to melting, which was the subject of that evening's lecture. Thanks to the wholehearted and enthusiastic support of the industry, much had been done to help founders, and Mr. Woods expressed his gratitude for the invitation for him to attend the present meeting and thanked foundrymen at large for their past co-operation with his department.

"New Ideas in Melting"

Next, the president introduced the evening's lecturers to their audience. Taking the subject of "New Ideas in Melting," the paper described extensive research which had been carried out to investigate the practical possibilities of a new conception in melting methods. It originated from an effort to improve environmental conditions in non-ferrous foundries when the lecturers, working for the Joint Standing Committee on Conditions in Non-Ferrous Foundries, came to the conclusion that really high-speed melting would much improve thermal environments in melting shops and could, at the same time, afford metallurgical and financial advantages.

Mr. Lawrie presented the joint paper and first dealt with the improvement in working conditions over the years, which had been followed by the early development of reverberatory melting.* He then dealt with the melting of aluminium and bronze by rapid heating of small quantities†, plus good furnace insulation, *e.g.*, it was held that direct melting of metal could be both cheap and fast and if it was fast enough, there was no oxidation, no gas pick-up and no melting loss. He felt that to melt metal in bulk for intermittent use subsequently was fundamentally wrong, because fume control for such furnaces might cost up to £5,000 or more and ladle fumes could not be controlled at all.

Thus, the logical thing to do was to bring moulds to the furnace and to heat metal so rapidly that the melting cycle was of less duration than mould making. Mr. Lawrie said he proposed to stick to generalities about this new idea of melting rather than describe new designs of furnaces. As one example, however, a gas-fired furnace to which he was referring had melted 100 lb. of bronze in 7-11 minutes, and now charges were satisfactorily melted at the rate of 10 lb. per minute. This furnace, he said, was expected to be working and on view at the Engineering and Marine Exhibition to be held at Olympia, London, this year.

In his contribution in support of Mr. Lawrie, Mr. Ayres defined melting in a bale-out furnace as "like boiling a bathful of water to make tea for a week," and said that the principle of melting which Mr. Lawrie had described could also be applied even to large continuous-casting installations by multiplying, say, quite small oxypropane-fired melting units. Founders, he concluded, should tell equipment makers what they wanted and co-operate with them in development of plant.

Before the discussion of the lecture commenced, Mr. Ayres made a plea to his audience that it was well to bear in mind that the method of melting described need not be confined solely to non-ferrous metals—there were distinct possibilities in its application to metals of quite high melting points.

Discussion

Open discussion of the paper at the meeting brought some interesting replies although it became apparent that founders would have preferred to have given to them cut-and-dried applications of the new ideas rather than be faced with the necessity of development work themselves. Amongst the comments passed between audience and lecturers emerged the following facts:—That with such rapid melting, temperature control was relatively easy; that "slugs" of the right size for melting could presumably be arranged as on a machine-gun cartridge belt for die-casting applications; that a short melting flame was advantageous; that electricity could possibly be used as a heat source, but 1,500 deg. C. was necessary in the unit to melt 3½ lb. of aluminium in 3 minutes. As to purity, it was stated that melting was so rapid that no refining was necessary and that when using oil as a fuel, flame impingement was important. In applications of both oil and gas to the new system, founders were assured of co-operation by suppliers of these fuels.

Mr. P. B. Higgins proposed the vote of thanks to the lecturers and thanked also the London branch for the invitation extended to himself and the other visitors. He congratulated Mr. Lawrie and Mr. Ayres on their constructive thinking and said that one should remember that the foundry industry was 3,000 years' old and

*See "Construction of an Oil-fired Reverberatory Furnace for Melting Aluminium," by G. A. Hodges, FOUNDRY TRADE JOURNAL, November 12, 1959, and "Non-ferrous Reverberatory Furnace," by E. Ayres and W. B. Lawrie, JOURNAL, August 18, 1960.

†For example, see "Furnace for High-speed Intermittent Melting," by E. Ayres and W. B. Lawrie, JOURNAL, September 29, 1960.

change hitherto had been very slow. He hoped the present lecture might act as a "spur" to new thinking, the development dealt with at the meeting could possibly turn out to be one of the biggest in the foundry industry for the last 50 years. Finally, Mr. Higgins exhorted foundrymen to try out such melting methods for themselves.

Seconding the vote of thanks, Mr. G. Burgess also expressed interest in and appreciation of the new idea of melting, but as an ironfounder added that he was relieved to find the cupola would still be needed in foundries!

United Steel's Reunion Dinner

United Steel Companies, Limited, held their annual reunion dinner at the Kenwood Hall, Sheffield, on March 29, when there were present more than 100 former technical apprentices who are now taking degree courses at universities. Mr. H. Darnell, general works manager, Steel, Peech & Tozer, said that the proposed expansion projects of United Steel would raise the amount of capital per worker by £1,500 to a figure of £5,900 a head. He added that the industry was very highly capitalised, and with the exception of the Steel Company of Wales—largely developed since the war—United Steel had spent more money per employee on capital investment than any other steel company.

Mr. Darnell outlined some of the expansion projects and said that because the company was expanding and was subject to intense competition, the management was constantly on the lookout for young men who could be groomed ultimately to take over senior executive posts. It was a regular occurrence for there to be executive cross-posting between companies in the group. Experiments by the company with temporary graduate foremen in order to provide young university-trained men with direct experience in man-management, he added, had worked very satisfactorily, and the graduates themselves had found the experience extremely valuable.

Charging ESC Furnaces

English Steel Corporation, Limited, plan to charge their furnaces at the Tinsley Park, Sheffield, development, by revolutionary methods. Mr. E. Worthington, work-study engineer, outlined the plans to delegates at a two-day work-study conference of the Vickers group on March 29. It is proposed that the 100-ton electric furnaces should be fed from a giant overhead "basket" holding 60 to 70 tons of scrap with incoming scrap tipped directly into the basket from railway wagons. It is thought that this will be the first time that feeding direct from rail wagons has been carried out in this country, and work-study and operational research techniques are being used to plan it. It is planned to avoid double-handling of scrap. The method will provide a considerable saving of time on the electro-magnet method, in which furnaces are fed with loads varying from five cwt. to a ton.

Mr. Worthington said that everything depended on a regular flow of scrap trains, so that there would be no lifting from stock. "We will, in fact, have a stock of about 9,000 tons, but we hope never to use it." He said the company was thinking in terms of a train coming in on the average every two-and-a-quarter hours. In its final form, the scheme would need 20,000 tons of scrap a week, which meant that 16 wagons would have to be discharged every hour to keep the melting shops working.

Finland to join EFTA

Under an agreement of association between the member states of the European Free Trade Association (EFTA) and Finland signed in Helsinki recently, Finland assumes broadly the same commercial rights and obligations as the members of EFTA have already assumed between themselves. The exception as far as tariffs are concerned is that Finland may reduce her import duties on certain goods in accordance with a retarded timetable (but must catch up again with the standard timetable by January 1, 1967); the main goods in question are textiles, tyres, and a range of iron and steel manufactures. The other exception is that Finland may also retain indefinitely her quantitative restrictions on imports of certain other goods—solid and liquid fuels, tars, bitumen, etc., and certain kinds of fertilisers (in the list of excepted products there appear "central-heating boilers"). The agreement will come into force when all the eight signatory countries have deposited formal instruments of acceptance.

The first tariff reductions are to become operative on July 1, 1961. Except for goods which the importing country has declared as revenue items, the cuts will affect all industrial goods which under the origin rules of the Stockholm Convention are entitled to area treatment. On those goods where Finland may retard her reductions, her basic duties will at this first stage come down by only 20 per cent.; but the reductions on the other goods in Finland, and all the reductions in the EFTA countries, will be cuts of 30 per cent.* Subject to certain exceptions the basic rates of duty from which Finland will calculate her tariff reductions will be those ruling on June 1, 1960. A White Paper giving the text of the agreement will be published shortly.

* The EFTA countries reduced their duties towards one another by 20 per cent. on July 1, 1960; they have already agreed to make a further 10 per cent. reduction on July 1, 1961.

Research Warning for Scots Firms

Scottish firms should take more advantage of the Government-sponsored research establishments, warns Mr. Lindsay B. Aitken, an executive of the Scottish Council (Development & Industry). He says that more companies must become research-minded if Scotland is not to lag behind industrially. "How many Scottish companies realize that they have access to, and in fact pay for, a £10,000,000 per annum research department, and how many seem to be interested?" asks Mr. Aitken.

He points out that the Department of Scientific and Industrial Research spends this amount on scientific research for application to trade and industry, and discloses that of 200 Scots firms who last year received an invitation from DSIR to inspect one of its laboratories, only 15 companies were sufficiently interested to reply, and a mere 11 took advantage of the offer. He emphasizes that all industries are now becoming more and more dependent on science and that no company can afford to ignore this without jeopardizing its future.

Going Abroad? Notes for the guidance of businessmen who intend visiting specific overseas countries on export business may be obtained on application to the Directories and Notices Section, Board of Trade, Room 0348, Horse Guards Avenue, London, S.W.1. (Phone TRAfalgar 8855, ext. 2928.)

GLOVER & MAIN, LIMITED—Mr. Lyle Pixton has joined the board.

Engineering, Marine, Welding and Nuclear Exhibition 1961

As previously reported in the JOURNAL *the Engineering, Marine, Welding and Nuclear Energy Exhibition will take place at the Olympia, London, from Thursday, April 20 to Thursday, May 4. Among the numerous official visits will be the following of interest to foundrymen:—Institute of British Foundrymen, Thursday, May 4; National Society of Master Patternmakers, Wednesday, April 26; Foundry Trades' Equipment and Supplies Association, Monday, April 24; Council of Ironfoundry Associations, Tuesday, May 2. Amongst the large number of stands some of those having exhibits that will engage the attention of foundrymen are reviewed below. The details of the items have been abstracted from the various company's own descriptions of the main features of their stands. For ease of reference the companies have been listed in alphabetical order.**

AEI, LIMITED, Transformer Division (V5, ground floor, Empire). Exhibits will include the latest welding equipment and most of the major items will be shown in operation. Included will be the new "Gazelle" electrode for welding mild steel, submerged-arc welding equipment, the Paradyne, Thermac, and Atomic-hydrogen welding sets, and a heavy-duty projection welding machine.

AEI Turbine-Generator Division occupies stand No. 9 (Row F, Grand Hall). Most of the products of the division, including steam and gas turbines, generators, heat exchangers and marine machinery and plant are on display.

W. H. ALLEN, SONS & COMPANY, LIMITED (1, Row D, Grand Hall). The range of exhibits represents some of the company's specialized activities in the supply of power plant, pumping machinery and electrical equipment for service on board ship and on land.

ATLAS-COPCO (GREAT BRITAIN), LIMITED (4, Row R, ground floor, National Hall), will be displaying their compressors and air tools amongst which is the T6 compressor which will be of particular interest to owners of small foundries. This is a two-stage, single-acting machine with intercooler built for a normal working pressure of 100 p.s.i. and delivering 140 c.f.m.

W. & T. AVERY, LIMITED (3, Row H). This company's display of testing machines will include the 1,200 lb. Universal Testing Machine fitted with a new design of self-contained servo operated autographic recorder, a 25-ton Universal Testing Machine equipped with high temperature furnace and control, a Visual-hardness Testing Machine, for Vickers diamond pyramid tests, and the Direct-reading Hardness Testing Machine, designed to carry out the Rockwell test.

BAKER PERKINS, LIMITED (3, Row U), is showing an automatic anti-creep device, which is controlled electronically by a scanner and automatically ensures that the vessel does not spiral off the rotator rolls. Two of the new Yates Twin Pillar Columns with retractable booms will be operating, complete with automatic-welding heads. In addition on this company's stand rotators from 100 lb. to 100 tons capacity will be displayed and demonstrated. A 5-ton Rocking Manipulator will be on view.

KEITH BLACKMAN, LIMITED (1, Row A, ground floor, Grand Hall). On this company's stand will be seen a selection of general and marine fan equipment.

BRITISH ENGINEERS' ASSOCIATION (Centre, ground floor, Grand Hall). This stand will serve as the engineering information centre for the exhibition. A selection of nuclear films will be shown.

BRITISH INDUSTRIAL GASES, LIMITED (6, Empire Hall), are exhibiting their range of oxygen-fed cutting tools for welding, cutting, heating, flame cleaning, gouging, etc.

BRITISH OXYGEN COMPANY, LIMITED (Engineering-G5, Grand Hall; Light Industrial-W1, Empire Hall; Electrical Welding-W5, Empire Hall), will be showing a wide range of new equipment on their three stands and demonstrating the latest techniques and advances in the production and distribution of industrial liquids and gases.

BRITISH ROTOTHERM COMPANY, LIMITED (13, inner row, gallery, Grand Hall), will be displaying a comprehensive range of dial thermometers, recorders, and controllers.

BROCKHOUSE GROUP (11, ground floor, Grand Hall). Among members of the group will be KAYE ALLOY CASTINGS, LIMITED, showing examples of gravity and pressure die-castings in aluminium and zinc alloy; and R. J. HUNT AND SON, LIMITED, examples of quantity production grey-iron castings for the engineering trades.

BROOM & WADE, LIMITED (8, Row H, Grand Hall), will be exhibiting a range of stationary air compressors with outputs from 3 to 525 c.f.m., including examples of compressors delivering oil-free air. Other exhibits will include the now well-known Mini-hoists of ½ and 1 ton capacity together with multi-purpose Par-a-matic tools for various production operations.

DAVID BROWN INDUSTRIES, LIMITED (P4, National Hall). The main item from the Foundries Division will be the David Brown-Bingham pump, of the centrifugal double-volute type. Also on view will be a wide range of gearing equipment and a selection of bronze and steel castings.

CARTER GEARS, LIMITED (9, Row AA, first floor, Empire Hall), will have a number of working and static examples of their range of variable speed gears on their stand.

THE GEORGE COHEN 600 GROUP, LIMITED (1, Row G, ground floor, Grand Hall). Amongst this company's display of light and heavy shaping machines will be the Barnes 100-ton hydraulic down-stroking press.

CONSOLIDATED PNEUMATIC TOOL COMPANY, LIMITED (6, Row C, Grand Hall). Working demonstrations of a large number of tools from their pneumatic and high frequency electric ranges, in addition to a static display which includes a number of new items, are the main feature of this stand which will include a demonstration of a number of grinders from the range produced by the company. A static display on the stand includes two examples of the range of worm gear jacks in addition to a selection of aero-hammers, chipping hammers, scaling hammers, grinders and balancers.

** In brackets are given in each case the Stand number and location of the exhibit.*

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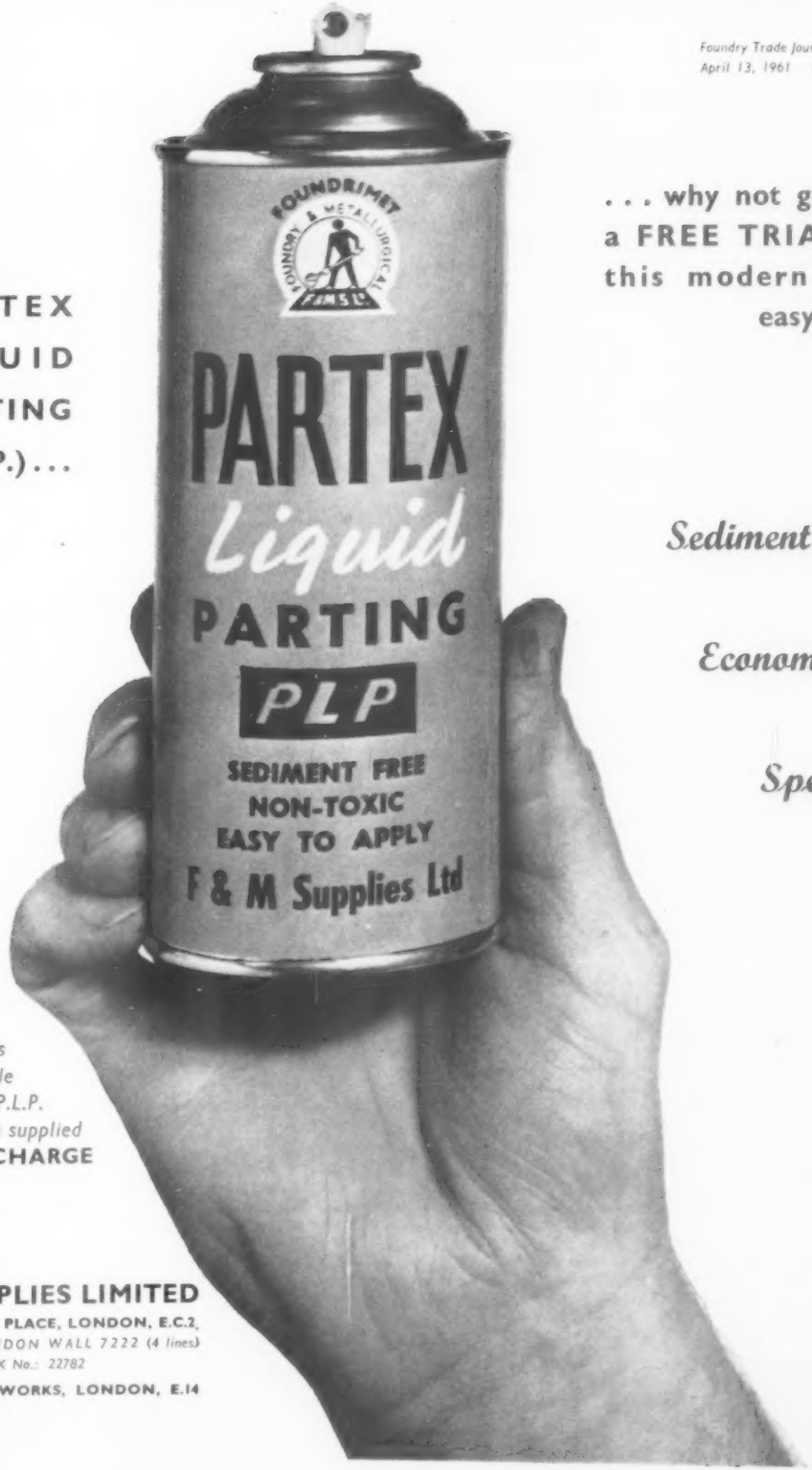

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TELEX No.: 22782
FACTORY: CONCORDIA WORKS, LONDON, E.14

Engineering and Marine Exhibition

DALLOW LAMBERT & COMPANY, LIMITED (3, Row BB) will represent their dust-removal apparatus with a range of five varied units to cover a wide industrial usage including foundries.

DELTA METAL COMPANY, LIMITED (5, Row BB, Empire Hall). Exhibits will include those of the SANDWELL CASTING COMPANY, comprising sandcastings in aluminium, brass, gunmetal and bronze. Gravity-die-castings in aluminium and brass. Pressure-die-castings in aluminium.

DESOUTTER GROUP (12, Row J, ground floor, Grand Hall). There will be a complete range of Desoutter pneumatic and electric power tools on show and the Die Set Division will be exhibiting a selection of the 2,000 different standardized die-sets available.

ENGLISH ELECTRIC COMPANY, LIMITED. The main exhibit on Stand Q6 is a new range of rotary electric actuators for the automatic control of valves in chemical plants, nuclear projects, foundries, and any installation where valve control is needed. A full range of arc welding equipment, electrodes and accessories is being shown by the Welding Division (W4, Empire Hall). There will also be welding demonstrations.

ENGLISH STEEL CORPORATION, LIMITED (15, Row H, ground floor, Grand Hall), will be emphasizing through their subsidiary company, Darlington Forge, Limited, the company's products for the nuclear energy industry, and the main feature of display will be a 5-ton forged-steel gas-duct reinforcement ring. Other products of this company, such as cast steel sternframes for the marine industry, hoppers and bells for blast furnaces and cast steel rolling-mill housings, will be featured pictorially.

THOS. FIRTH & JOHN BROWN, LIMITED (7, Row Q, National Hall). As alloy steel makers, forgemasters, heavy engineers and steelfounders, Firth Brown will be displaying a representative range of all their products, including high-grade steel castings for heavy duty wear, especially for use in the quarry, cement and associated industries. Research facilities will adequately be illustrated in the stand design.

FIRTH-VICKERS STAINLESS STEELS, LIMITED (13, inner row, gallery, National Hall). The theme of this stand will be technical collaboration between producer, fabricator and designer, but there will be shown examples of centrispinnings, precision, shell-moulded and static castings that can be produced in Firth-Vickers foundries and tables showing the properties of steels available in these forms will be on display.

GAS COUNCIL (5, Row N, National Hall). Here the emphasis will be on automation. Amongst many items of interest to foundrymen there will be seen for the first time a brass-billet heating furnace, which can be set to discharge billets automatically at a predetermined rate or singly by the operator pushing a button. Also there will be the prototype of a flash-melting machine in which the particular qualities of gas have enabled the development of a new process to melt non-ferrous metals far more rapidly and economically than by existing methods. It has a rate of melting of 5 to 5½ cwt. per hr.

GOODYEAR PUMPS, LIMITED (4, Row DD, first floor, Empire Hall), are exhibiting a range of pumps, in bronze and stainless steel, for marine and industrial use, as well as complete unit pumping systems with pre-wired electrical equipment, ready for immediate installation.

W. C. HOLMES & COMPANY, LIMITED (7, Row DD, first floor, Empire Hall). This stand will show much equipment with application in foundries, including an inert-gas generator, positive-air blowers, various types of dust collection and control plant, and an electrical air filter.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, Divisions —Metals and Billingham—and Marston Excelsior, Limited (an I.C.I. subsidiary company), will be represented at the Exhibition (30, Grand Hall Gallery). Exhibits are being shown in four main groups—nuclear engineering; titanium; heat exchangers and heat exchange products; and general engineering materials.

INTERNATIONAL COMBUSTION, LIMITED, INTERNATIONAL COMBUSTION PRODUCTS, LIMITED, RILEY (IC) PRODUCTS, LIMITED (3K, ground floor, Grand Hall). The combined exhibits of this group of companies display new developments including a sectioned scale-model of the 550-mw boiler unit for Thorpe Marsh Power Station. Among other International Combustion items are the Raymond flash drying system, new sizes of Vacseal pumps, the Dynoscreen centrifuge and new screening equipment. Riley (IC) Products show a new stoker, the Riley Miniature Type "TT" chain grate stoker, designed for the larger type of boiler. Also on display are recent advances in oil-burner equipment.

LEE, HOWL & COMPANY, LIMITED (2, Row N, ground floor, National Hall). Among this company's pumps to be shown will be the "Hypersilid" centrifugal chemical pump made of silicon iron castings (supplied by Bradley & Foster, Limited, of Darlaston) to enable it to handle corrosive liquors, including strong acids at any temperature or concentration.

LEYLAND MOTORS, LIMITED (on Stand D.14), will be exhibiting a wide range of diesel engines. They will also have on view a selection of castings from the Leyland Group's West Yorkshire and Farington Foundries. Amongst these are cast iron cylinder and general-high-quality repetition iron castings; aluminium sand, die and pressure-die-castings; and steel castings.

MARTONAIR, LIMITED (24, outer row, gallery, National Hall), will be displaying a wide range of pneumatic equipment including a tray lift designed to work from an airline of 80 psi, an airline filter involving a very low pressure drop, airline lubricators, and a range of control valves.

MAXAM POWER, LIMITED (4, Grand Hall Gallery), are placing on display a comprehensive range of fluid-power control equipment.

MUREX WELDING PROCESSES, LIMITED (2, Row W, ground floor, Empire Hall). Exhibits to be shown will mainly emphasise the use of automatic welding and will include a typical welding installation for general and Class 1 work and a working demonstration of the versatile "Muramatic" automatic welding head. But also being shown will be new and improved versions of existing manual metal-arc welding electrodes.

A. & S. OSMOND, LIMITED, will be showing a representative range of abrasive wheel cut-off and sawing machines, including a sawing model known as Type "Y" fitted with a pedal-operated vice. Two sizes of laboratory machines will be demonstrated.

Electrical Aids in Industry *Data Sheet* **No. 17**

Canteen Catering

As in every other industry, the main factors governing the economics of the catering business are: quality of product, cost of production, and well-being of workpeople. Electricity measures up well to these three essential factors.

The outstanding virtue of electricity is better cooking, particularly in roasting and pastry ovens where high quality is more easily maintained than in ovens using other forms of heat.

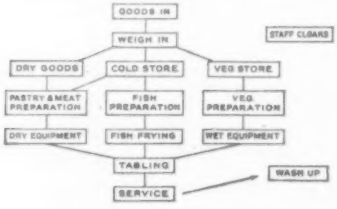
The cost of production varies somewhat with the type of food and the size of the establishment, but is usually between ½ and ¾ of a unit of electricity per meal. Cleanliness of electric cooking is axiomatic and provides better working conditions for the staff.

The actual size of the kitchen is influenced greatly by its shape and by the number of people catered for, but a rough guide is as follows:

Kitchen to deal with up to:	*Size:*
100 persons	5-6 sq. ft. per person
100-250 persons	4-5 sq. ft. per person
250-1000 persons	3-4 sq. ft. per person
over: 1000 persons	3 sq. ft. per person

Design

Where the kitchen is designed from the start for the full use of electricity, planning is simplified as the equipment can be placed where it is required without reference to the need for flues.

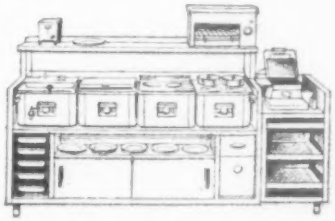


If an existing kitchen is already using other types of cooking equipment, however, electrical equipment can still be introduced item by item to bring increasing benefits.

Quick-service Equipment

The popularity of the quick-service establishment where the food is cooked at the service counter in the full view of the customer is steadily growing, and this type of catering can readily be provided in the canteen by the installation of a Back Bar cooking unit, installed behind a section of the service counter.

The popularity of the mid-day joint and two vegetables is on the wane and the really up-to-date canteen should provide the welcome alternative of fresh food cooked on the spot.



Electric Catering Equipment

Electric catering equipment covers every single kitchen activity and some of the appliances in common use are:

COOKING. Ranges, boiling tables, steaming, roasting and pastry ovens, vegetable boilers, fryers, griller/toasters.

SERVICE AND WASHING-UP EQUIPMENT. Bains-marie, hot cupboards, washing-up machines for the larger kitchen and sterilising sinks for the smaller, refrigerated cold-service counter and display cabinets, soda fountains.

PREPARATION. Mixing machines with attachments for chopping and mincing, etc., potato peeler, slicing machine.

QUICK-SERVICE EQUIPMENT. Infra-red (contact) grill, automatic toaster, griddle plate, automatic fryer, boiling plates, soup heaters, etc., and, of course, the indispensable refrigerator.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Tel: TEMple Bar 9434.

Excellent reference books on the industrial and commercial uses of electricity are available—"Electric Commercial Catering Handbook" (5/-, or 5/6 post free) is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity, including commercial catering. Ask for a catalogue.

12799/4

CUT HERE

Engineering and Marine Exhibition

PANTAK, LIMITED (14, outer row, gallery, Grand Hall), are exhibiting the full range of Balteau portable industrial X-ray units. Also on show will be a selection of radiographs taken by equipment ranging from a small lightweight gas-filled unit of 150 kv. to a mobile industrial betatron of 18 mev.

PYRENE COMPANY, LIMITED, Metal Finishing Division (17, inner row, gallery, National Hall). The theme of this stand illustrates the application of Bonderizing and Parkerizing phosphating processes at the initial manufacturing stages of steel parts and in their final finishing treatments. Parkerizing as a rustproofing finish will be demonstrated.

RICHARDSONS, WESTGARTH AND COMPANY, LIMITED (7, Row G., Grand Hall). Exhibits will include various products developed for Trawsfynydd Nuclear Power Station, among others an entirely new type bellows restraint mechanism, a CO_2 blower rotor and scale model cascade corner bend for the CO_2 circuit. A marine products section will show a number of marine power installations.

SMITHS INDUSTRIAL DIVISION will be represented on two stands; ultrasonic flaw-detection equipment (3Z, ground floor, Empire Hall) and industrial instruments (31, inner row, Grand Hall). In addition, Smiths high-speed pen recording equipment can be seen in conjunction with Sciaky welding machines (5X, ground floor, Empire Hall).

SUFFOLK IRON FOUNDRY (1920), LIMITED (3Y, Empire Hall). Among a number of other cutting machines this company will demonstrate for the first time at this Exhibition their S.I.F.75 Cutamatic Precision Oxy-flame Cutters. There will also be shown a range of welding rods and a demonstration of the use of Sifbronze.

TECALEMIT, LIMITED (7, Row K), will display a range of products including high-pressure nylon hose, nylon tubing, injection mouldings and lubricating equipment. Among other items will be hand lubricating guns, ribbon elements for the high flow filtration of air, hydraulic and lubricating oils, and also air breathers.

JOHN THOMPSON, LIMITED (3, Row F, Grand Hall). Together with a wide variety of boiler equipment and other items comprising bulk of the stand there will be displayed castings for the machine tool industry and on the stand will be a cylinder block casting for a 6-cylinder diesel engine, supplied to The National Gas and Oil Engine, Limited.

G. & J. WEIR, LIMITED (2, Row F, Grand Hall). Four completely new units will be shown, as well as a number of well-established products, and two subsidiary companies will also be showing their products. Mainly marine equipment there are included a two-stage flash evaporator, a high-vacuum exhaust steam turbine and a sea-water distillation plant.

WORTHINGTON-SIMPSON, LIMITED (4, Row S, ground floor, National Hall), will be showing a representative selection of "Monobloc," centrifugal, steam and power pumps, together with reciprocating and rotary air compressors. A working model of an automatic priming system will also be on view.

Export Opportunities

The Board of Trade have circulated the following information about foundry plant and equipment required for export to various countries:

An electric/oil-operated hardening and tempering furnace is required for India, inside dimensions about 6-ft. deep, 4-ft. wide and 1-ft. 9-in. high to operate at about 1,200 deg. C. Offers should be made to the chief engineer, Madras Port Trust, Madras, by April 21. Copies of the documents, ref. ESB/10478/61 relating to this enquiry are available from the Export Services Branch, Board of Trade (Theobalds Road, London, W.C.1) at a cost of 21s.

Tenders are invited for the supply, erection and commissioning of two 'slingers (ramming capacity 20 cu. ft. per min.) for the steel foundry, Indian Railways, Chittaranjan Locomotive Works, Chittaranjan, West Bengal. The cost of tender papers (Rs. 25) should be remitted either in cash or by money order to the chief accountant, Chittaranjan Locomotive Works, quoting tender No. SFM-60/09/11-A, and the cash receipt forwarded to the deputy chief mechanical engineer, steel foundry, Chittaranjan Locomotive Works, along with the application for tender papers. Tenders are being invited from all over the world, and documents are also available from the director-general, India Store Department, Government Buildings, Bromyard Avenue, Acton, London, W.3. (Closing date for receipt of tenders is June 5.)

Also required for the Chittaranjan Locomotive Works are the following items of plant for the works' steel foundry which has an initial annual capacity of 7,000 tons of castings to be expanded to 10,000 tons yearly.

Tender No. SFM-60-00-9A, heat-treatment furnaces comprising (*a*) two annealing, normalizing and tempering furnaces, (*b*) set of heat-treatment trays, (*c*) furnace-charging machine, (*d*) heat-treatment furnace for manganese steel railway crossings, and (*e*) water-quenching system for the railway crossings. For these items, the cost of tender papers is Rs. 50 and application can be made to same address as for tender No. SFM-60/09/11-A (closing date: June 12).

The Chittaranjan Locomotive Works also invite tenders for two mould-drying stoves (tender No. SFM-60/00/8A) and one vertical core stove and one horizontal core stove (tender No. SFM-60/09/7A). These two tender forms cost Rs. 50 each and are available from address given previously (closing date for tenders is June 12).

Mr. Omer S. Smith, Industrial Oil Division, Smith Oil & Refining Company, 1104, Kilburn Avenue, Rochford, Illinois, USA, has informed the British Consulate General at Chicago that his company would be interested in acting as distributors for UK manufacturers of chaplets and studs, wooden and metal patterns, and moulding equipment. The company manufacture core oils and would like to find additional items which could be sold in conjunction with the core oils. Companies interested in this agency enquiry should write direct by air mail to Mr. O. S. Smith. Quotations should show both f.o.b. and c.i.f. prices in US dollars and it would be appreciated if firms would send a copy of their initial correspondence to the British Consulate General, 200, South Michigan Avenue, Chicago, 41, Illinois.

Mr. J. A. PERKINS has been appointed a director of the Elgar Machine Tool Company, Limited. Mr. J. G. FAHEY has resigned his directorship and left the service of the company.

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(mixtures of refractory aggregate with Ciment Fondu and Secar 250)

For use up to 1800°C

For every refractory application

For the convenience of users, ready prepared

*CASTABLES

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can be obtained from all leading refractory manufacturers

*Such premixes are in the correct proportions of cement and graded aggregate and only require the addition of water before mixing and placing. Practically any size and shape can be cold-cast true to dimension and put into use 24 hours after making.

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CIMENT FONDU ALUMINOUS CEMENT — up to 1350°C

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News in Brief

A CARGO AND PASSENGER LINER for the Port Line will be launched at Harland & Wolff's Belfast shipyard on May 31, 50 years to the day since the Titanic was launched at the same yard, in 1911.

A NEW DRYDOCK, capable of accommodating ships up to 110,000 tons d.w., will be built at Schiedam, Holland, for the Wilton Feyenoord Dock & Shipyard Company. The work is expected to take 2½ years. In the meantime, one of the company's floating docks is being enlarged.

GUTHRIE, ADAMS & COMPANY, analytical chemists and metallurgical and foundry consultants, of Leeds, have been appointed foundry consultants to the Hashemite Kingdom of Jordan. The firm's representative is at present in that country making a survey of the local foundry industry.

GENERAL ELECTRIC COMPANY, LIMITED, has received a repeat order valued at £139,000, for the supply and installation of a second 100,000 c.f.m. turbo-blower at the Cleveland Works of Dorman Long (Steel), Limited. The machine previously ordered is already under construction at the Fraser & Chalmers Engineering Works of GEC.

INCANDESCENT HEAT COMPANY, LIMITED, report notable installations of Whiting wet-type cupola dust arresters, erected during the holiday periods of 1960. These include four at R. J. Hunt & Son, Limited, three at Midland Motor Cylinder Company, Limited, two at the Austin Motor Company, Limited, and two at David Caird, Limited.

RICHARDSONS WESTGARTH (HARTLEPOOL), LIMITED, have received from the Central Electricity Generating Board a letter of intent for the supply of four complete sets of condensing and feed-heating plant, value approaching £3,000,000, for the 350 mw turbo-alternators to be installed at Tilbury "B" power station. The plant is of an entirely new design, developed by the Richardsons Westgarth group.

ALLIED IRONFOUNDERS, LIMITED, Falkirk, have secured a contract worth more than £40,000 for the provision of kitchens and auxiliary equipment in the headquarters of the National Iranian Oil Company in Teheran. The equipment, which is to be manufactured in Falkirk, will be designed to cater for a staff of more than 1,000. Installation of the kitchens on the site, due to take place this summer, will be supervised by the company's own engineers.

DAVID BROWN FOUNDRIES DIVISION, Penistone, near Sheffield, has recently despatched to Takoradi, Accra, West Africa, a David Brown Bingham double-volute single-stage centrifugal pump. It has been supplied to BP Trading, Limited, for incorporation in the Air BP West Africa Hydrant scheme. The pumps are a new line of product which the company is now making under a manufacturing agreement recently drawn up with the Bingham Pump Company of Portland, Oregon, USA.

TWO NEW FACTORY BUILDINGS of modern design have been acquired by Adrema, Limited, Telford Way, London, W.3, to form their first satellite plant of 20,000 sq. ft. area on the Bilton Estate, Portsmouth. They are situated in Western Road a few hundred yards off the A.27 main road from Portsmouth to Chichester, at Cosham in north Portsmouth. The plant will bring the total factory area of Adrema, Limited, to 130,000 sq. ft. Further reconstruction at the firm's premises in Telford Way, London, will add another 27,000 sq. ft.

THE INDUSTRIAL EQUIPMENT AND SERVICES EXHIBITION is to be held in Bingley Hall, Birmingham, from May 29 to June 3. The British Institute of Management, the Birmingham branch of the Purchasing Officers' Association, the Institute of Industrial Supervisors, and the Illuminating Engineering Society have agreed to give it their support. A Careers Exhibition, organized by the civic authorities, will be held during the same period in another part of Bingley Hall; it is expected that H.R.H. the Duke of Edinburgh will visit the latter exhibition.

THE CERRO CORPORATION, of Chile (formerly the Cerro de Pasco Corporation) has so far spent about US $5,400,000 of an estimated total of US $95,000,000 in preliminary building work at the new Rio Blanco mine which it acquired early in 1960. The site—65 km. north of Santiago and 3,600 m. above sea-level—has reserves totalling about 120,000,000 tons of ore which should yield some 1,900,000 tons of copper. Preparing the mine for operation is expected to require another five years, by which time the yearly output capacity should be 60,000 tons.

RALEIGH INDUSTRIES, LIMITED, are closing four factories to reorganize production over a three-year period "to surmount intense foreign competition" and uneconomic operation, it was announced on April 7. This follows the merger with Tube Investments, Limited, last June. All cycles are to be manufactured at Nottingham, and all mopeds, scooters and motorcycles at Birmingham. The reorganization means that production at the Norman Cycles factory at Ashford, Kent, and the Sun Cycles & Fittings, and Brooks and Wrights saddle factories at Birmingham will be transferred to the new centres.

THE FIFTH OF A SERIES OF cargo liners, built by the British-India Steam Navigation Company for the Australian-Asia run, was launched on March 29 at Glasgow by Mrs. P. R. Searcy, wife of the senior Australian Trade Commissioner in Britain. The 6,500-ton ship has been named Bombala after a township in southern New South Wales. A shipping company spokesman stated that the new vessel represented the culmination of a £A7,000,000 investment in trade links between Asia and Australia. The Bombala will join four other company ships operating between Malaya, Ceylon, India and the Persian Gulf.

THE NEDERLANDSCHE DOK EN SCHEEPSBOUW MAATSCHAPPIJ, of Amsterdam, Holland, has received an order from the Companhia Nacional de Navegaçao, of Lisbon, to build a modern fast 11,900-ton motor freighter with accommodation for 12 passengers. The vessel will be ready to sail early in 1963. The ship will be built in conjunction with a Portuguese yard that will construct the hull according to drawings and with materials supplied by the Dutch company. After launching in Portugal, the hull will be towed to Amsterdam to be completed there by the N.D.S.Mij., which will also supply and instal the entire propulsion equipment.

SHEFFIELD HEALTH COMMITTEE has recommended the approval in principle of the Woodseats smoke-control area, comprising 1,800 acres on the southerly side of the city and including 6,800 houses and 240 commercial and industrial premises. The Minister of Housing and Local Government has confirmed the Hallam (No. 7) Smoke Control Area and it will become operative by July 1, 1962. There are 7,000 residential properties, as well as commercial and industrial premises. The total cost of appiying the scheme will be £206,000, of which £60,930 will be met by grant from Sheffield Corporation and £87,243 by the Government.

BIG SHOTS

Baker Perkins offer a complete range of Shot Blasting Machinery covering all requirements.

The range includes Rotating Barrel type machines for bulk handling of small pieces, Rotary Table type machines for continuous production, Swing Table type machines for treating a very wide range of pieces, and Shot Blast Rooms for large-scale operations on fabricated pieces and structural work.

Whatever your need — whether it's plate cleaning, shot peening, descaling, *or any application where you suspect you may be breaking new ground* and would like experienced advice and co-operation — get in touch with Baker Perkins. Why not write for illustrated literature and performance details of the range?

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BP/F12a

Raw Material Markets

Iron and Steel

Current production of the foundry grades of pig-iron is maintained at levels which ensure adequate supplies for consumption and any stock requirements, although few foundries carry stocks of any size, as the ease with which they can obtain supplies does not favour forward buying. All grades of foundry pig-irons are readily available, and if called upon producers could step up deliveries appreciably.

The call for the low phosphorus pig-irons, which are mainly used by the engineering and speciality foundries, continues at substantial levels, while good quantities of hematite and, to a lesser extent, refined irons are also taken up by them. The demand for high phosphorus irons, while steady, shows no noticeable increase on recent deliveries, due chiefly to the moderate usage by many of the light, jobbing and textile foundries. These furnaces also have tonnages to spare, and are able to continue to supply to overseas buyers when orders can be obtained, although export merchants are faced with severe competition from makers abroad. The steelworks also are able to acquire their needs of basic pig-iron. Overall production of this grade is sufficient to cover consumption and stock requirements.

Most of the engineering and speciality foundries continue reasonably well employed by the demand for high-quality castings. The light foundries show little change in their trading position, and much more work could be undertaken by most of them, as well as by the jobbing and textile foundries.

Scrap available is generally sufficient for current needs, although arisings of the better and heavier grades of cast-iron scrap are not too plentiful. Foundry coke, ganister, limestone, and firebricks are available to requirements.

The re-rollers are fairly well provided with work and are able to maintain reasonably good outputs of small bars and light sections, while the call for reinforcing rods and bars is sustained at high levels. Delivery dates for most of their products have improved as arrears of orders become liquidated. The re-rolling mills are well provided with mild steel semis, and stocks held by them appear to be adequate in many instances to meet current production requirements, there being only a limited demand on home steelworks for supplies. All arisings at the steelworks of suitable re-rolling quality defectives and crops are taken up by the re-rollers.

Non-ferrous Metals

Copper in London after a somewhat indifferent performance last week has now come to life and activity is at a high level. This been mainly due to a much improved consumer demand from the UK which, in turn, arises from the better economic conditions experienced in several sections of industry. Yet, the disturbed political situation in the Congo and in the Far East has also led to a steady demand from both of these sources and, too, there have been sporadic bursts of interest from the Continent. Even so, copper stocks in LME warehouses last week rose by 396 tons to 15,368 tons, their highest for a month.

The better feeling concerning the business outlook on both sides of the Atlantic has already been reflected in buoyant stock market conditions in both countries and the outlook is for the copper price to go higher rather than lower.

In the US more optimism has been generated about the economy and this may be reflected in the copper statistics for this month when they are published. Meanwhile the price structure is unchanged with 29 cents a pound applicable to both producers and custom smelters.

Tin has been a strong and buoyant market in London, Singapore, and New York where the price has gone above $1.06 a pound. In London demand has been widespread with orders coming from the Continent, the US, and Canada. At the beginning of the week the cash price soared to £840 a ton and such was the strength of the market that there was no action taken by the Buffer Stock Manager. However, the rise has probably been too steep and there is almost bound to be a reaction. Nevertheless, the outlook for tin remains bright and is enhanced by the belief that the Buffer Stock Manager has only about 10,000 tons with which to "play" the market, whereas the expected shortfall this year is estimated at 15,000 tons.

Lead in London is quietly steady with the price edging up slowly. In the US demand has improved and the price is firm at 11 cents a pound. Zinc has also shown renewed vigour in London and despite offerings of metal from the Continent, the price has recovered the ground it lost following the publication of the Lead and Zinc Study Group Report. In the US the improved business outlook combined with better demand and higher production figures of steel and automobiles has resulted in a firmer market. The US price is unaltered at 11½ cents a pound.

"Meat" for the "Sandwich"!

Students—eight in number—attending the first-year of the "sandwich" course for an advanced diploma at the National Foundry College, Wolverhampton, paid visits to a number of foundries in the Gloucester area during the week commencing March 27. On the first day, they went to Gloucester Foundry Company, Limited, on the Tuesday to Newman, Hender & Company, Limited, on Wednesday to Meigh Castings, Limited (Cheltenham), and R. A. Lister & Company, Limited (Dursley), in the afternoon; on Friday, they visited the foundries and other shops of Bristol Siddeley Engines, Limited, at Filton, near Bristol. In this way, with the exception of steelfounding, the students were able to see excellent examples of almost all types of foundrywork—in grey-iron, light-alloy, yellow metal and precision foundries. At all locations, generous hospitality was dispensed by the firms and the whole tour proved most instructive and interesting.

Latest Foundry Statistics

Ironfounding: An increase in the number employed in iron foundries in the UK during the period December 3, 1960, to January 28, 1961, is revealed in figures recently released by the Council of Ironfoundry Associations. During the week ending December 3 there were 131,232 employees, this increased to 131,406 by the end of the month and was virtually the same on January 28 (131,395). The figure for January, 1961, shows an increase of 2,996 over that for January last year.

Training for the Future?

As the JOURNAL goes to Press it is announced that the Russian airman who on Wednesday was the first man to encircle the earth while more than 100 miles up in space, was originally trained as a foundryman.

Personal

Mr. E. L. BUSH, chairman of W. J. Bush, Limited, has been appointed a director of Albright & Wilson (Mfg.), Limited.

Mr. W. RYDEHEARD, secretary of the company since 1940, has been appointed a director of Newtons (Ironfounders), Limited, Vickers Street, Manchester.

A technical representative with Fisher & Ludlow, Limited, Mr. JOHN G. PARKER has been selected as a Liberal candidate for the May municipal elections in Marple (Cheshire).

Mr. JOHN MARSH has accepted an invitation to become director of the British Institute of Management from October 1. Since 1950 he has been director of the Industrial Welfare Society.

Mr. RAYMOND V. ELY, a specialist in the field of the application of electrical transformers to X-ray technology, has been appointed consultant to Gresham Transformers, Limited, of Hanworth, Middlesex.

Mr. J. GARDNER, general secretary of the Amalgamated Union of Foundry Workers for many years until his retirement in 1958, is in Crumpsall Hospital, Manchester, where he is said to be making satisfactory progress after an operation.

H.R.H. THE DUKE OF EDINBURGH is giving to-day, Thursday, the Graham Clark Lecture at the Institution of Civil Engineers before a gathering which includes members of the Institution of Mechanical Engineers and the Institution of Electrical Engineers.

Mr. W. G. CALLON of the Malleable Casting Company of New Zealand, Limited, left the UK on April 10 for a continental visit prior to his return to New Zealand. With Mrs. Callon, he had been in this country for about a month on a business visit.

Mr. E. B. BISHOP has been appointed secretary of Metal Cleaning, Limited, a member of the Castrol group of companies. He succeeds Mr. G. J. B. WILLIAMS who now becomes responsible for the company's reorganization and sales development. Both Mr. Bishop and Mr. Williams are directors of Metal Cleaning.

Thos. W. Ward, Limited, have appointed Mr. STANLEY JESSOP, until recently sales manager of Fredk. Town & Sons, Limited, and Woodhouse & Mitchell, Limited, machine-tool companies of the Thos. W. Ward group, to be manager of their Glasgow depot. Mr. Jessop has spent all his business life with Thos. W. Ward whom he joined in 1928. He has served the company for long periods in Sheffield, in the North Midlands and in India.

Mr. DERRICK H. CARTER has been appointed chairman of the general chemicals division of Imperial Chemical Industries, Limited, in succession to Mr. HAROLD SMITH who has been appointed to the main board of ICI. Mr. Carter is succeeded as joint managing director (commercial) of the division by Mr. JOHN L. TEDBURY, a director of the division. Mr. Tedbury is also deputy chairman and joint managing director of Plant Protection, Limited, an ICI subsidiary.

Mr. G. R. BUCKLEY and Mr. E. M. SUMMERS, directors of the Stanton Ironworks Company, Limited, Mr. E. M. MARVILL, director and general manager of the Sheepbridge Company, Limited, and Mr. R. F. A. TURNER, have been elected directors of the Staveley Iron & Chemical Company, Limited. Mr. Turner has been appointed general manager of Staveley works. The appointments have been made following the resignation of Mr. S. N. TURNER and the retirement of Mr. C. H. M. OWEN.

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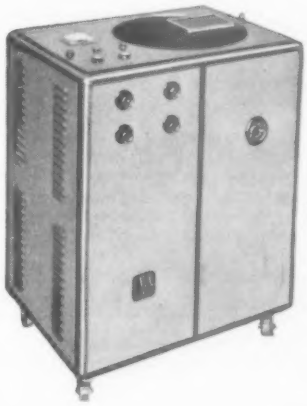

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated)

April 12, 1961

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P 10-ton lots or over, £23 5s. 0d., delivered Birmingham £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d. South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £45 0s. 0d. to £48 0s. 0d., scale 15s. 0d. per unit, lumpy, 75 per cent. Si, £62 0s. 0d. to £66 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s.10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 11d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 11d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C,* 1s. 9¾d to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free £275 0s. 0d.; 96/98 per cent., £285 0s.0d.

Ferro-columbium.—65/67 per cent. Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £58 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t.s. 100 tons and over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons and over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C, £40 11s. 0d.; silico-manganese, £43 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 11s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £230 5s. 0d. to £230 10s. 0d.; three months, £231 5s. 0d. to £231 10s. 0d.; settlement, £230 10s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 2½d. per lb.; rods, 244s. 6d. per cwt. basis; 20 s.w.g., 279s. 6d. per cwt.

Tin.—Cash, £838 10s. 0d. to £839 0s. 0d.; three months £847 10s. 0d. to £847 10s. 0d.; settlement, £839 0s. 0d.

Lead (Refined Pig).—First half April, £67 0s. 0d. to £67 2s. 6d.; first half July, £68 5s. 0d. to £68 7s. 6d.; settlement, £67 2s. 6d.

Zinc.—First half April, £84 7s. 6d. to £84 10s. 0d.; first half July, £84 5s. 0d. to £84 7s. 6d.; settlement, £84 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £122 7s. 6d.; rolled zinc (boiler plates), all English destinations, £121 2s. 6d.; zinc oxide (Red Seal); d/d buyers' premises, £97 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10d. per lb.; sheets to 10 w.g., 200s. 0d. per cwt.; wire, 2s. 8½d.; rolled metal, 200s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £178; B6, £226.

Brass (High Tensile).—BS1400, HTB1, £197; HTB2 £216; HTB3, £232.

Gunmetal.—BS1400, LG2, £222; LG3, £232; G1, ½%, £296; G1, 1%, £286.

Phosphor Bronze.—BS1400, PB1 (AID released), £312 BS1400, 90/10/1, £301.

Leaded Phosphor Bronze.—BS1400, LPB1, £244.

Phosphor Bronze Strip, etc.—Strip, 287s. 3d. per cwt.; wire, 4s. 1d per lb.; rods, 3s. 4d.; tubes, 3s. 4d.; chill cast bars, solids 3s. 3¾d.; cored 3s. 4¾d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 3½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 2½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £230 0s. 0d. Quicksilver, ex-warehouse, £69 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £246; AB2, £254.

* Average 68-70 per cent.

Company News

DANIEL ADAMSON & COMPANY, LIMITED, water tube boiler makers, etc., of Dukinfield (Ches)—Group pre-tax profits fell to £10,403 (£98,503) and the total dividend is cut by 7 per cent. to 8 per cent. with a 5 per cent. final.

METAL CLOSURES, LIMITED—The dividend is being raised from the equivalent of 9·6 per cent. to 11¼ per cent. for 1960 with a final of 6¼ per cent. Group profits expanded from £856,066 to £1,121,177 and the net profit from £482,788 to £596,311.

BAKER PERKINS, LIMITED, manufacturing engineers, iron, steel, and brass founders, etc., of Peterborough—The company is acquiring James Halley & Sons, Limited, makers of rotary printing machinery, etc., of West Bromwich, for £178,800 cash.

MORGAN CRUCIBLE COMPANY, LIMITED—Reorganization of the company has been completed and it became a holding company on April 4. As reported previously, five new wholly-owned subsidiaries have assumed the responsibilities for production, trading, research, and development.

MILLOM HEMATITE ORE & IRON COMPANY, LIMITED, pig-iron makers and founders, of Millom (Cumberland)—The company, a subsidiary of the Cranleigh, Limited, group, has acquired for a nominal consideration all of the share capital of Sadler & Company (Coke Ovens), Limited, of Evenwood (Co. Durham).

F. W. BERK & COMPANY, LIMITED—The authorized share capital has been increased from £2,000,000 to £2,250,000 by the creation of 1,000,000 additional ordinary shares of 5s. each which have been allotted in satisfaction of the purchase consideration for the whole of the issued share capital of St. Albans Sand & Gravel Company, Limited.

R. W. CRABTREE & SONS, LIMITED—Share capital of the Cundall Folding Machine Company, Limited, which specializes in the manufacture of paper-folding machinery and feeders, has been acquired. The company will continue to be directed by Mr. Trevor Miller. Mr. S. D. Miller will also remain on the board. Mr. Charles H. Crabtree, Mr. Peter N. Crabtree and Mr. A. Rayner will join the board of Cundall, representing the parent company. Mr. C. H. Crabtree will be chairman.

DELTA METAL, LIMITED—The chairman, Mr. W. E. Ogden, points out that in any programme of development there must inevitably be periods when a considerable amount of spadework has to be done with little immediate gain and it is likely the group may be entering such a phase now. However, when new plans now in hand fructify, profits "should take another surge forward." It is proposed to create 16,000,000 new 5s. ordinary shares, but the board has no immediate issue plans.

EXPANDED METAL COMPANY, LIMITED—At present the business is developing at a satisfactory rate, says Sir Patrick G. Hamilton, chairman, and the profits of 1961 and 1962 will bear the costs of developments. The directors propose to increase the authorized ordinary capital by 3,300,000 5s. shares, so that adequate capital is readily available. There is no present intention of issuing any of the new shares, and the board says it would seek stockholders' approval if it intended to issue shares "so as to cause a radical variation of control of the company, or the nature of its business."

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CLASSIFIED ADVERTISEMENTS

PREPAID RATES: **Twenty words for 10/- (minimum charge) and 4d. per word thereafter. Box numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

5 PER CENT. Commission, plus expenses. This basis only entertained. Expert technical / commercial, practical FOUNDRYMAN (freelance), car, 53, introduce upwards potential £50/80,000 p.a. Business (ferrous, non-ferrous). Excellent prices. Principals only. Midland foundry essential. Box CP698, FOUNDRY TRADE JOURNAL.

PLANT ENGINEER (41) seeks new post in large Modern Mechanised Foundry. Good background and experience embracing installation, maintenance, planning and development. Qualifications include: M.I.Plant E., M.I.B.F. Salary required: £2,000 p.a. Housing assistance, car, etc. Box PE671, FOUNDRY TRADE JOURNAL.

REPRESENTATIVE, life experience Foundry trade, technical (54), practical, thorough knowledge prices, excellent contacts West Midlands; car. I wish to contact medium West Midland Foundry. Salary, expenses, commission. Box RL678, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

CENTRAL SCOTLAND. Established Foundry requires FOREMAN MOULDER to control production of Alloy and Grey Iron castings up to 2 tons in green, dry and CO$_2$ sand. Staff position with pension scheme etc. State experience and salary required. Box CS674, FOUNDRY TRADE JOURNAL.

METALLURGIST, age 30-35, L.I.M. or H.N.C. in metallurgy, required for development work in the preparation of exothermic feeding compounds and fluxes for the foundry trade. Varied and interesting work—five-day week—superannuation scheme.

Reply in confidence to HARBOROUGH CONSTRUCTION COMPANY, LIMITED, Foundry Supplies Division, Harbilt Works, Logan Street, Market Harborough.

SALES REPRESENTATIVE

AN immediate vacancy exists for a first class Representative to operate an area covering Birmingham and the Midlands.

The minimum qualification is at least five years' experience selling steel castings of all types and a wide connection in the Industry. A knowledge of Foundry Practice would be desirable.

Applications are invited from candidates 30-40 years old who should be resident in the Area.

The appointment will be on the Monthly Staff. A Pension Scheme is in operation, a Company car will be provided and a generous salary offered to the successful applicant.

Applications, marked "Confidential," giving details of career, should be sent to the Director, Wolsingham Steel Company Limited, Wolsingham, Bishop Auckland, Co. Durham.

SITUATIONS VACANT—*contd.*

BRITISH INDUSTRIAL SAND LTD. require a JUNIOR TECHNICAL SALES REPRESENTATIVE for North East Coast. Aged 25/30, education at least to G.C.E. standard and willing to travel extensively in the area. Preference given to man with foundry experience especially A.M.I.B.F. Good salary, company car and pension scheme. There are excellent prospects for a man seeking to make his career in an expanding organisation. Written application with full details to the NORTHERN AREA SALES MANAGER, BRITISH INDUSTRIAL SAND LTD., 47 Pilgrim Street, Newcastle upon Tyne, 1.

Advertisers whose announcements appear under a box number are urged to acknowledge, however briefly and informally, all replies received. This particularly applies to advertisements under "Situations Vacant"; serious inconvenience and, sometimes, real hardship can be caused to applicants who receive no indication even of the safe receipt of their communication. Failure to acknowledge replies can also reflect on the good faith of this journal, which is responsible for their onward transmission. If it is desired to maintain anonymity, an acknowledgement on plain paper, quoting the relevant box number, is all that is necessary.

SITUATIONS VACANT—*contd.*

SALES REPRESENTATIVE required by large repetition Iron Founders, North Midlands. Previous experience in engineering or foundry trades essential, good prospects leading to executive position, car provided, pension scheme. Write stating age, experience and salary required. Box SR679, FOUNDRY TRADE JOURNAL.

CENTRAL SCOTLAND. Established Foundry requires FOREMAN CORE-MAKER. Must be experienced in production of Cores in Oil, CO$_2$, Shell, etc. for production quantities and heavy castings up to 2 tons. Staff position with pension scheme, etc. State experience and salary required. Box EF675, FOUNDRY TRADE JOURNAL.

TECHNICAL REPRESENTATIVE (Castings) required for London and Home Counties north of the Thames. Experience in similar capacity, or foundry/mechanical engineering background necessary. Write to J. D. S. TOWNSHEND & CO. LTD., Founders' Representatives, 12, South Drive, Banstead, Surrey.

SKILLED FALSE-CORE MOULDER required, London, W.9, for small shop producing engineering, art, castings in lead, bronze, aluminium. Must be able to mix own alloys, experience in lead-burning, brazing would be advantageous. Please state experience and salary required. Box SF699, FOUNDRY TRADE JOURNAL.

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VICTORIA, AUSTRALIA

We have been retained to select candidates for this appointment with a rapidly expanding mechanical Iron Foundry making automotive castings. The Compainy is a subsidiary of a leading U.K. organisation.

Age range 35-50

Comprehensive foundry operating experience on mass production castings essential together with the quality of leadership and sound managerial ability.

Commencing Salary £A4,000
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Service Agreement, considerate Pension Scheme and housing arranged. Free travel to Australia for the successful candidate and his family.

This position offers an opportunity for a career in the growing economy of Australia with the benefits of its climate and amenities for the family.

Candidates should apply in confidence, quoting ref. FWM/TJ stating age, education, qualifications, recent earnings and experience, to:

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Brook House, Park Lane, London, W.1.

Every application will be acknowledged.

SITUATIONS VACANT—contd.

CHEMIST and Junior required for laboratory analysis of non-ferrous metals, now S.E.1, later Woolwich. Write GENERAL WORKS MANAGER, A. COHEN & CO. LTD., Rothsay Street, S.E.1.

H. J. MAYBREY & CO. LTD.

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Only first class men experienced in the production of high quality castings should apply. Contributory Pension Scheme after Probationary period. Good salary according to qualifications.

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FIRST CLASS PATTERN MAKERS AND MOULDERS

for first quality Aluminium Castings required for our Elmers End Foundry.

Apply:— **H. J. MAYBREY & CO. LTD. CROYDON ROAD, ELMERS END, BECKENHAM, KENT. TEL:- BEC 34921**

SITUATIONS VACANT—contd.

REPRESENTATIVE required for Non-ferrous Foundry, Home Counties, capable of working on own initiative. This position, which carries prospects to board level, would suit a well connected energetic person, age 30-40. Apply giving full details of experience to MANAGING DIRECTOR, Box RR672, FOUNDRY TRADE JOURNAL.

EAST SUSSEX ENGINEERING CO. LTD.,

Phoenix Iron Works, Lewes, Sussex

require

METALLURGIST

for large Grey Iron and Non Ferrous Foundry. Applicants should be around 35 years of age and have had previous experience in metal and sand control, and the production of high duty Grey Irons. A knowledge of Non Ferrous metallurgy is also desirable. The successful applicant, who must have held a similar position for at least five years, will be responsible to the Foundry Manager.

Write stating age, experience and salary required to the Technical Director.

SITUATIONS VACANT—contd.

COREMAKER. An experienced Coremaker for large cores required for foundry in West Riding of Yorkshire. Position offers scope for man about 30-40 years with initiative and drive. Give details of experience, age, salary required. Reply to THE MANAGER, Box CM676 FOUNDRY TRADE JOURNAL.

METALLURGIST required for Iron and Steel Foundry in Essex. Practical experience in Modern Electric Arc Furnace practice essential. Sand control and all-round metallurgical background. Apply stating age, experience and salary required to Box MR691, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

WANTED, very cheaply, old but just workable two MC NAB or B.M.M. H.L.P. 1 or 2 machines. Well over scrap price paid. Box WV673, FOUNDRY TRADE JOURNAL.

WANTED, Shot Blast Machine, table type, 7 ft. to 8 ft. in diameter. Send full particulars and where it can be inspected to Box SB696, FOUNDRY TRADE JOURNAL.

REQUIRED

TWO FURNACES for the Heat Treatment of Aluminium and its Alloys. One in the solution range. One in the Precipitation range. Medium capacity—electric or gas.
Please reply to:—

CAMBRIAN CASTINGS LTD., Trading Estate, Hirwaun, Aberdare, Glamorgan.

LEIGH & SILLAVAN LIMITED

require a

MANAGER

for their

Pig Iron & Ferro Alloys Department

Due to the retirement of the present Manager this old established Firm of Pig Iron and Non Ferrous Metal Merchants is looking for a man with an extensive knowledge of Pig Iron and Ferro Alloys and the merchanting and distribution of them.

The Manager will be immediately responsible to the Directors and will take over the administration of this important Department at the Company's Head Office in Manchester. The Department services and supports an outside sales force by continuous telephone and postal contact with Principals, Producers, Customers and its outside Representatives.

Applicants should please write in confidence stating age, experience and salary required to:—

The Directors,
Leigh & Sillavan Limited,
Arkwright House, Manchester 3.

MACHINERY FOR SALE

FOR SALE. Cupola, 3 ft. dia., water cooled. Complete with fan. New 1957. Box CF670, FOUNDRY TRADE JOURNAL.

TWW

COLEMAN WALLWORK WT563 Jolt Squeeze Straight Draw Moulding Machine, 22½ in. × 19 in. table.
Coleman Wallwork WT563C Jolt Squeeze Straight Draw Moulding Machine, 35 in. × 24 in. table.
Type HPL3 Jolt Squeeze Pattern Draw Moulding Machine by B.M.M., table 36 in. × 25 in.
Macnab Rollover Pattern Draw Moulding Machine, table 46 in. × 50 in.
Coleman Wallwork WT562C Jolt Squeeze Turnover Moulding Machines, table 35 in. × 54 in.
RD2 Model V245 Jolt Squeeze Turnover Moulding Machine by B.M.M., table 36 in. × 25 in.
Sand Slinger, radius 9 ft., with three motors, 400/3/50 by Foundry Plant & Machinery Co.
Linslade No. 1 Sand Slinger, 10 ft. radius, by Foundry Equipment Co.
August No. 3 Sand Mill, pan 8 ft. dia. × 4 ft. deep, cap. 10/15 ton/hr.
Motor driven Hexagonal Rumbling Barrel, 30 in. across the flats × 48 in. long, 12½ h.p. Motor and Starter, 400/3/50.
Motor driven Cleaning & Polishing Rumbling Barrel, 26 in. across flats × 38 in. long. Motor Drive.
10 ton Collin Geared Crane Ladle.
New Geared Foundry Crane Ladles (10 cwt. to 3 ton cap. in stock).
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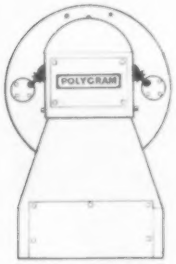

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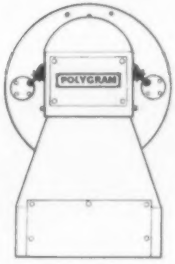

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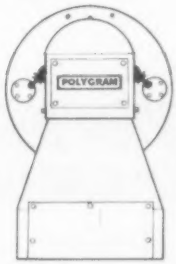

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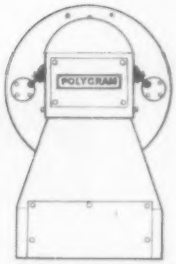

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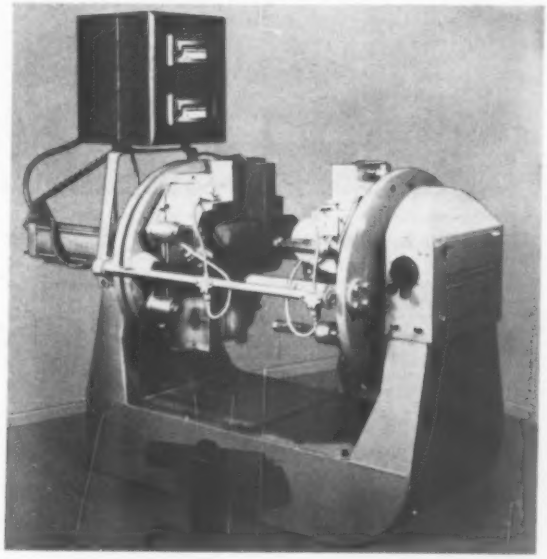

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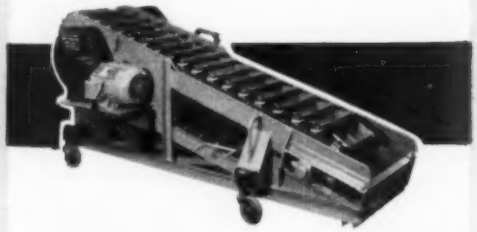

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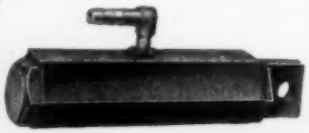

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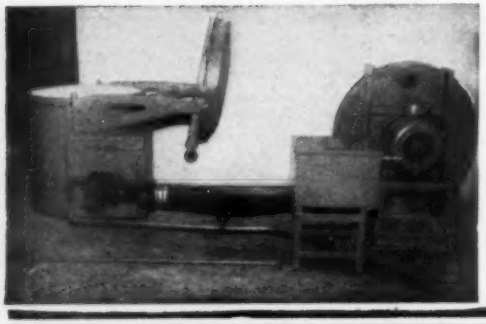

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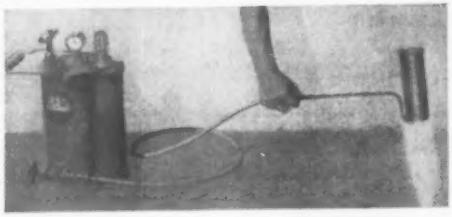

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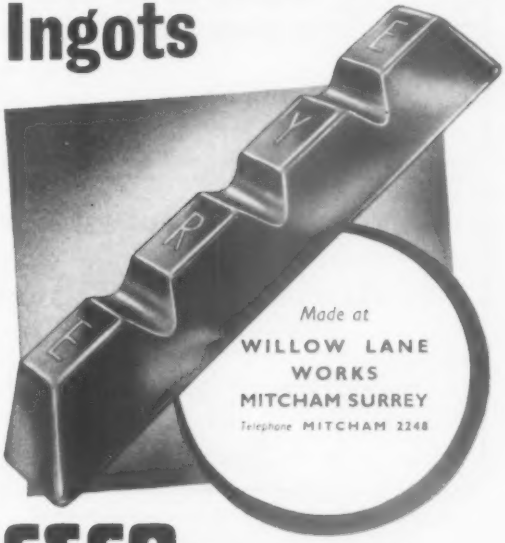

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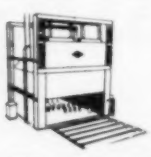

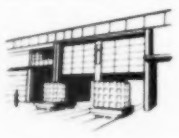

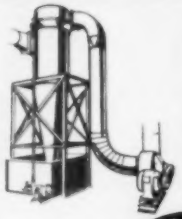

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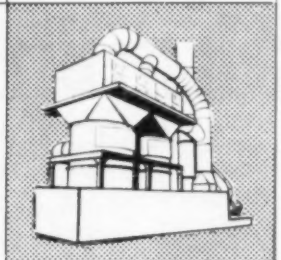

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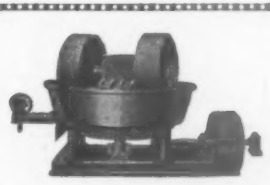

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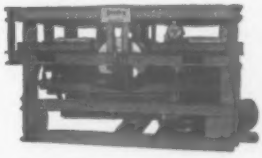

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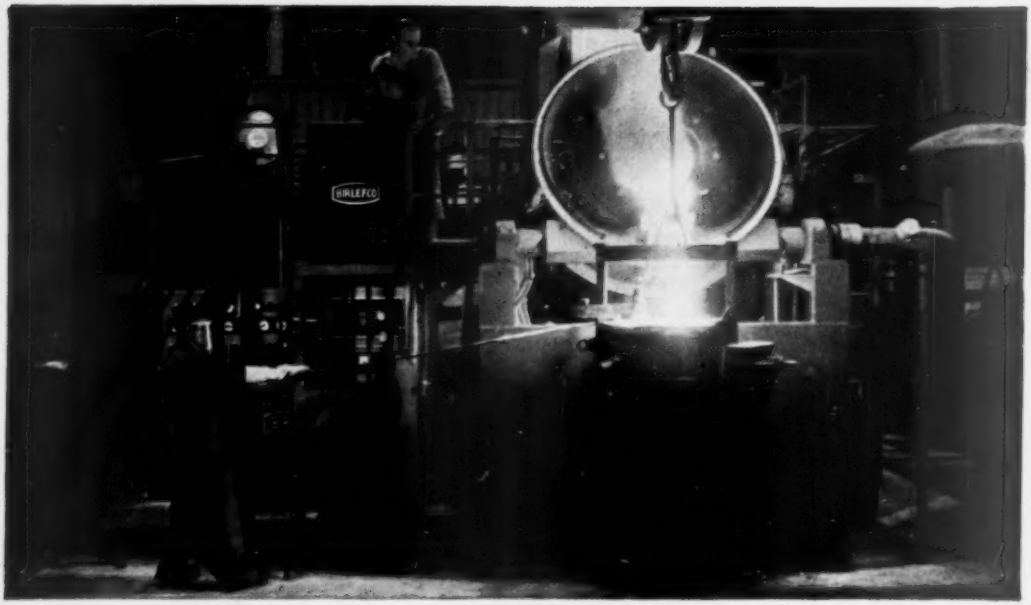

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